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Vol. V. NEW YORK, FEB. 14, 1885. No. 7.

Handsomely bound volumes of THE ELECTRICAL WORLD *for* 1884 *are now ready, and will be sent, charges prepaid, to any address on receipt of* $5.00.

THE Baltimore & Ohio Telegraph Company maintains its serenity in spite of the strenuous efforts being made to cut off from it the financial backing of the railroad company. It is not likely that its enemies will succeed in their plot.

BY means of the Gillett telephone, Mr. Phil. Armour, the Chicago meat magnate, informed his friends in this city, one night last week, that the "run of cattle" for the day there was 5,000. The experiments were not wholly successful, but it was once more shown that conversation could be carried on with ease telephonically by persons at least 1,000 miles apart.

CABLES are becoming every year of greater value to England in the maintenance and administration of her vast empire. The value of the Mediterranean service has been demonstrated frequently since England took a hand in the settlement of the Egyptian question; and in view of the great desirability of being well-informed with regard to the course of events on the West Coast of Africa, the English colonial authorities now are willing to subsidize a cable opening up to telegraphic communication all the settlements in that region.

OF making applications of electricity there is no end, and some of these applications might naturally "give us pause" in amusement or alarm at their ingenuity. Last week the socialists who met at Chicago boasted that by means of electricity they could very quickly gain their worst ends, and this week in our Patent Record a description is given of a device for the base-ball field, by means of which an electric alarm is sounded in the umpire's ear and an indicator is operated, whenever the runner steps on a base. Electricity is the modern "maid-of-all-work."

THE recent explosions of natural gas in Pittsburgh have led to extreme vigilance on the part of the natural gas companies. The lines of the Fuel Gas Company are patrolled from end to end in order that the slightest leak may be stopped. Some difficulty has been experienced in working about the pipes at night, as there was danger of the gas communicating with the lights. The miners' safety lamps did not give light enough, and an open lantern was apt to cause an explosion. To overcome this difficulty portable batteries and incandescent electric lamps have been purchased, and the men now work with as much safety at night as during the day.

WE publish to-day an interesting description of the manner in which the telephone has been utilized in London and in Paris. The showing for Paris is by far the better of the two. But there are many signs of improvement in England, and one of them is the establishment in Manchester, Liverpool, Blackburn, Preston and other North Country cities or towns of public "call offices." The charge for speaking within the city limits is 6 cents for three minutes or under, and 12 cents for three minutes for conversation with persons beyond the city limits. In the south of England, at Devonport, great strides are being made in the employment of the telephone.

THE news that the Exchange Telegraph Company has been expelled from the interior of the London Stock Exchange has already been published by us. Our English contemporaries just to hand supplement the cabled news with the statement that three months' notice will be given to determine the company's tenancy. What the company propose to do we show elsewhere by quoting from their explanation of the position they occupy. The feeling appears to prevail in London that the company suffers on account of the resolve of the "jobbers" on the Exchange to keep the public from knowing the run of prices, the tape having been an inconvenient check to their operations.

IT is said to be the intention of the English Government, at the next session of Parliament—provided, of course, there are no more distractions in the shape of dynamite explosions and troubles in Egypt—to obtain a select committee of the House of Commons, which shall ascertain the best mode of dealing with telegraph and telephone wires along, over or under the public thoroughfares. Local authorities are jealous, however, of any interference with their rights in the matter, and the London vestries and district boards have just passed a series of resolutions in which they pat themselves on the back as being the persons and powers best qualified to deal with the question. They have, nevertheless, consented magnanimously to the holding of an inquiry on the subject.

THERE is likely to be what Mr. Conkling would call a "neighborly and scientific argument"—or, in the popular phrase, a "knock-out"—between the exasperated Mr. A. K. Phillips and the manager of one of the Atlantic cables. Mr. Phillips, whose wife and daughter are in Wiesbaden, received a message saying, "Come on at once, Jeenette is lost." Frantic at the possibility of its being his daughter, Jeanie, he insisted on the cable artists trying again, when a correction came, "Come on at once. My teeth is lost." Several other idiotic messages worked Mr. Phillips up to such a point that he boarded the "Arizona" and sailed for Europe on the 27th ult. We expect he will turn up in some cable office in a frenzy and leave it in the condition of the merchant who called to remonstrate about a "subject to delay" message—during the strike—which read "Senk twi bassets eristers," and had one sleeve of his coat and half of his side-whiskers torn off by the faithful manager.

AS FAR as we are aware, no attempt has been made before that of Mr. Edward P. Thompson, in "An Analytical and Systematic Method of Inventing," now running in our pages, to examine minutely and in detail the opportunities of development and application presented in unfamiliar combinations of electrical principles. We advise young inventors, or even our readers who have spent their lives in inventing, to read this series of articles with care, as they will be found highly suggestive and stimulating to the practical imagination. In some of the rules and principles laid down are the germs of inventions that will yet startle the world. Take even the idea worked out toward the end of the present installment, as to making a pendulum hang directly away from the centre of the earth. There is something in it that an ingenious man can utilize profitably. Another subject treated at an earlier stage is "seeing by electricity." The possibilities of that field of discovery and invention are unlimited.

THE decision of Judge Simonton, of Pennsylvania, referred to by us last week and given more fully in this issue, that a telephone company is a telegraph company for all purposes of taxation where the law as written only applies to "every telegraph company," may or may not be good law, but the next decision, in some State other than Pennsylvania, may accentuate the queer diversities of law when brought to bear on telegraph companies. It has already been decided in one State that the printed contract on a message blank is not binding, and in another State that it is, while the laws in other States differ as to whether the sender or receiver of a message shall be competent to sue for damages. It seems to have been ever thus, for, even as late as 1827, as Mr. Reid tells us in his "Telegraph in America," when Harrison Gray Dyar, of this city, proposed to construct a telegraph line from New York to Philadelphia—twenty years before Morse got to work on a similar idea—the court issued a writ against him for "conspiracy to carry on a secret communication from city to city," whereupon the astounded and disgusted Dyar fled the country and took up his home abroad.

A CORRESPONDENT in one of our contemporaries records a curious accident to a dynamo. The machine was a Siemens 300-light incandescent, and fed the lamps through the medium of accumulators. For some days it ran very badly, and finally at every hour or so the accumulator discharged through the machine, destroying the safety fuse each time. The lamps burning at the time were not extinguished, because the fuse was on the dynamo side, so that current was still supplied to the lamp circuit from the cells. Careful examination was made, but nothing could be found to account for the failures. Eventually it was discovered that the engine driver had been cleaning the dynamo whilst it was running, and a thread of cotton waste had got wound round the armature spindle in such a way as to get wedged between the collar on the arbor and the bearing, so that every now and then the armature was so retarded by the friction (the belt at these times slipping), that the E. M. F. fell below that of the cells, causing the accidents. It was no easy task to discover the fault, being of a nature not likely to suggest itself, and the piece of cotton waste not being visible.

ANOTHER sad case of "marrying" by telegraph has just come to light in this city, and it better exemplifies the rank idiocy of such an absurd proceeding than the case reported recently in which the white bride, after going through the telegraphic farce of wedlock, found her husband was a colored barber. In the latest case, the lady—a widow—was personally acquainted with the man who deceived her. He represented himself to her, in Milwaukee, as a grain broker in this city, and after leaving there he wrote her from St. Louis saying he was suddenly summoned to Europe, and asking her to marry him by telegraph. An ecclesiastical crank of Chicago lent his aid to the blasphemous travesty on wedlock, and the pair were "married" by wire, the bride sending him, she said, "an electric kiss." His reply came from England in the shape of a request for a speedy remittance of $3,500 to help him in a business transaction. This was sent him and was followed by another request for $1,000, which sum was also sent, after which all trace of him was lost. The lady, who never saw her husband after the ill-advised marriage, was in this city recently hunting him up, with the prospect before her of a protracted search.

THE working operator has nowadays so few friends outside of his own fellow-workmen that the death of a friend like the late Mr. L. G. Tillotson is a particularly heavy loss to the profession. Much has been written from time to time about the dignity of telegraphic labor, but nothing has more fully covered the point than the following extract from a speech made to the operators by Mr. Tillotson fourteen years ago: "There are some who have sneered at the telegraphic profession, and there have, no doubt, been some who have, by their misconduct, brought it into contempt. Yet, I believe these are the exceptions which are to be found in every business. I believe there is to-day no more honorable calling, and none where a young man of character is more likely to be honored. It is a business in which the public are compelled to place confidence in the men who fill its offices, and to whom they intrust their most important and confidential interests. Character, in connection with the telegraph, is a necessity, and, when found, is certain to be appreciated. I believe that the telegraphic craft of this continent stands high in this respect among the citizens of the country. I also believe that the telegraph has been to a vast number of men a profitable profession. Men have left its ranks year after year to become governors of States, generals in the army, members of our Legislatures, officers of our government and influential as merchants or private citizens. It is a profession of which no man need be ashamed." There have been many changes since then, but the intervening period of fourteen years has served only to emphasize the truth of all that Mr. Tillotson said of the profession.

An Analytical and Systematic Method of Inventing.

BY EDWARD P. THOMPSON, M. E.

(*Continued from page* 57.)

Rule 3 directs the inventor to apply the principles of science to practical ends. The following columns contain a continuation of electrical principles deduced very carefully from facts and from the investigations of noted scientists. It has already been mentioned that the direction of proceeding consists either in deciding first upon what device or process is to be invented and then discovering whether any of the known principles may be applied, or in seeking to discover to what new device or process any one or more of the principles may be adapted. *All inventions are applications of principles.*

216. A magnetic field of force changes in its intensity more or less rapidly by variations of C., according to the manner in which the wire is coiled upon it; according to the amount and quality of the magnetic material of the core; according to whether the core is hollow or solid; and according to the style of pole pieces.

217. With no magnetic core, the variations of the magnetic field are synchronous with the variations of C.

218. With cores of steel, the variations of the magnetic attractions and repulsions, due to variations of the C. in the wire coiled upon the core, are very slight and very slow.

219. With cores of steel, the magnetic field varies least with variable medium Cs., and most with those Cs. which saturate the magnet.

220. With cores of soft iron, the variations of the magnetic field are quicker and larger than with those of steel; but more concentrated and less rapid than with no core.

221. With cores of soft iron, since the variations of the magnetic field are not synchronous with the variations of C., the more rapid the latter variations, the more nearly is the magnetic field constant or steady; and when the number of variations of C. becomes very rapid, the magnetic field becomes practically constant.

222. With cores of soft iron, intermittent variations of C. at long intervals produce approximately the same variations of strength of magnetic field as though there were no core; but the period of variation is longer than when no core is used.

223. When the wire is so wound as that there are more and more coils from the ends of the core to the centre, the variations of the magnetic field are less abrupt, and, therefore, the steadiness of the magnetic force is greater than when wound in any other manner; and especially is the steadiness greater than when the coils are crowded at one or both ends.

224. Variations of an electro-magnetic field are produced by external means; such as by the relative motion of other electro-magnets, permanent magnets, or soft iron; by heat, chemical affinity or by any of the other forms of force, any one or more of the above influences acting directly, indirectly, separately or jointly upon either the magnet or the C., or upon both.

225. A magnetic material becomes more and more magnetic with increase of C. up to a certain limit, where it becomes saturated.

226. When saturated, iron becomes no stronger in magnetism by slightly increasing C., and a very great increase of C. produces only a very slight increase in the total magnetic field, so that the law of relation between the C. and magnetic force holds good only below the point of saturation.

227. As the amount of solid a liquid will dissolve before the point of saturation is reached depends upon the mass of liquid, so an electro-magnet will not reach its point of saturation as quickly when the core is more or less porous or hollow.

228. The larger the mass of iron in proportion to the length of wire coiled around it, or the smaller the diameter of said wire (the C. not appreciably heating the wire), the less probable is it that the magnet will reach its point of saturation under the influence of the variations of C.

229. Chemically pure iron obeys the law of the relation between C. and magnetic force at a greater limit than iron containing any foreign substance, and is therefore not as soon saturated as any other material.

230. The rapidity of variation of magnetic force is greater as the length of the magnet is shorter, but the law of variation has not yet been accurately established.

231. The molecular structure of iron influences its magnetic properties.

232. When iron is of a fibrous nature, it is more quickly magnetized and demagnetized by winding the wire at right angles to the direction of the grain.

233. Iron, of whatever structure, is a conveyer of magnetic lines of force, so that by bending one or more parts of an electro-magnet, or by letting the ends of the core project outside the coils, or by pointing the ends of the core while projecting, or by making the iron of any shape, the line of force may be, but not perfectly, directed to any desirable position, or concentrated, or scattered.

234. Iron is not only a magnetic substance, but is also a conductor of C., so that a vibrating C. in the coils induces a C. or several Cs. in the iron.

235. If the Cs. in the iron of a magnet become sufficiently strong, the iron will become heated.

236. These Cs. are found to flow in nearly parallel lines so that by constructing the core in a suitable manner, the Cs. may be caused to neutralize each other; or they may be diverted simply to get them out of the way or to use them for any purpose whatever, or they may be made to flow in a different direction or in different directions from that which they formerly followed.

237. When the C. in the coils becomes so strong as to heat the wire, the latter causes the core to become heated, so that a core is often heated from two sources.

238. If at any time the C. is two or three or four times as great as it was an instant previously, the heat developed in the coil is respectively four or nine or sixteen times as great as before.

239. By multiplying the C., the magnetic force becomes multiplied in the same proportion, provided the length of the electro-magnet is a few times greater than its diameter, and provided the core is not at or approximately at its point of saturation.

240. Under the same conditions, by multiplying the number of coils, the C. becomes multiplied in the same proportion.

241. Cylinders, when wound with wire carrying C., will sustain greater weight than when the wire is of any other geometrical form in cross section; the diameter of the cylinder being equal to or greater than the longest diagonal or major axis of the other geometrical figures.

242. The breaking and completing of the C. results in the sudden vibrations of the core of an electro-magnet to such an extent as to produce an audible sound when said magnet has its end placed against a suitable sounding-board.

243. Sounds may be produced in a bar of iron by suspending it freely in a coil which does not touch the iron, and then by passing an intermittent C. through the coil.

244. The completing of a C. passing through coils around an iron core produces a sudden expansion of the iron, while the breaking of the same C. results in a contraction of the iron.

245. The alternate expansion and contraction (for instance by heat and cold) slightly magnetizes a bar or needle of steel.

246. A given permanent magnet loses more or less of its magnetism by a rise of temperature, and becomes practically demagnetized at a great heat.

247. A flash of lightning has an effect upon the strength of a magnet; the effect being due more probably to the electrical energy of the flash than to the light energy.

248. The strength of a permanent bar magnet remains longer, if its major axis is maintained in the magnetic meridian of the earth.

249. Permanent magnets made up of thin plates are not, in strength, equal to the sum of the magnetic forces of all the individual magnets; but the resultant of the sum may be approximated by making the central plates longer than the lateral plates.

250. Bar permanent magnets of the best quality sustain twenty times their weight, and horseshoe permanent magnets sustain forty-five times their weight, under the best circumstances.

251. By passing a C. through wire coiled around molten cast-iron, the latter become hollow irregularly.

252. The motion of an armature while being removed from a permanent magnet by mechanical force, restores to the latter approximately the same magnetic energy as was exerted in attracting the armature; the phenomenon being the same as the storing of mechanical energy by raising a weight from the earth or by coiling a spring.

253. The above principle furnishes by deduction the principle that the permanent magnet may be demagnetized by removing the armature without exerting upon the latter any outside mechanical force; the method consisting in passing a C. around the permanent magnet so that the north and south poles of the helix will be respectively at the south and north poles of the bar magnet.

254. By alternately breaking and connecting the C. in the above principle, the armature is vibrated against the resistance of gravitation or a spring, provided the C. is not so strong as to reverse the poles of the bar magnet.

255. Distance may be measured by the deflections of a magnetic needle, said deflections being produced by a permanent magnet, and a table having been prepared previously to state each deflection for each unit of distance.

256. A pendulum, made of a permanent magnet or soft iron suspended by a fine silk thread hangs so that the weight is between the point of support and the centre of the earth. By the use of a large permanent or electro-magnet located at a distance above the point of support, said distance being little greater than the total length of the pendulum, the pendulum will hang, as it were, directly away from the centre of the earth.

257. The upwardly hanging pendulum of the above principle will vibrate according to certain laws which in a general sense are the same as the laws of gravitation; but are different in certain particulars.

258. One difference consists in the condition that the centre of attraction of the earth is thousands of miles while the centre of attraction of the large permanent or electro-magnet is only an inch or so from the centre of the upwardly suspended pendulum. Other differences are:

259. The length of a seconds pendulum would not necessarily be equal to the length of the present seconds pendulum, and the length would vary with the strength of the large fixed permanent or electro-magnet located as described.

260. The ordinary pendulum is acted upon only by the attraction of the earth, while the upwardly suspended pendulum is acted upon both by the earth and by the large fixed magnet.

261. The effect of the earth's attraction will be varied according to the angle made between the lines radiating from the point of suspension of the pendulum to the centres, respectively, of the earth and of the large fixed magnet, which need not necessarily be located in a vertical line through the point of suspension.

262. The vibrations of the pendulum will depend, in their nature, upon the resultant effect of the force of the earth's and magnet's attractions and upon the angle at which the large fixed magnet is placed in reference to a vertical line passing through the point of suspension of the pendulum.

263. The tension on the thread may be regulated by the C. which energizes the magnet, so that, with a minimum C. the pendulum will suddenly drop into the natural position of a pendulum.

264. The weight of the pendulum bob may be increased or diminished the same as though a material substance were added to or subtracted from it, simply by increasing or diminishing the strength of the C.

265. The pendulum bob can be caused to vibrate not only as an ordinary pendulum; but it may be made to vibrate in the same manner as a magnetic needle around a vertical axis, especially if the bob be a bar or needle, and the supporting thread be divided near the bob into threads, each of which is attached at its end to an end of the bob, the thread being thus divided so as to hold the bob in a horizontal position.

(TO BE CONTINUED.)

The "Ticker" in London.

Since the committee of the London Stock Exchange decided to expel the Exchange Telegraph Company from the interior of the building, the company have issued an important circular to the following effect:

"As some misconception appears to exist in regard to the nature of the plan proposed by this company to facilitate business in 'non-current' stocks by means of our recording instruments, we beg to address you on the subject. It is intended by means of the 'tape' to announce instantaneously and simultaneously to all subscribers, being members of the Stock Exchange, that particular subscribers, also members of the Stock Exchange, are desirous of dealing in particular securities. The method contemplated is simple. A particular broker, being a buyer or seller of a security in which he can get no 'business' price made, and wishing in the interests of his client to find out a real seller or a real buyer, will instantly communicate to this office by telephone (which is already provided with the recording instrument) the fact that he is a dealer in such security. This announcement will be forthwith transmitted to every subscriber by affixing the broker's telephone number to the name of the security specified on the tape. By this means, within a minute and without leaving his office, it will be possible for a broker to lodge a 'notice' of his requirements at the office of every other broker in the Stock Exchange. By the mechanical combination of the 'tape and telephone' it will thus be seen that the physical obstacles of time and space in the constitution of the market are reduced to the minimum. The same result will be obtained as if every member had been personally addressed in the matter, but without the expenditure of the time and exertion occupied in so doing, and with the additional advantage that the intimation will of course bind no one. There are no other means available of securing the same results. Apart from the delay and difficulty incidental to posting 'notices' on the 'pillar,' as described in the Minutes of Evidence taken before the Royal Commission, or the trouble which would be involved in making an 'entry' in a 'register,' such as was suggested in the commissioners' report, it is obvious that a 'notice' when posted, or an 'entry' when made, must be in the nature of the case local, whereas the announcement made in the manner herein described will be widely disseminated. It is not possible to form an adequate opinion of the benefit of this plan in the absence of actual experience, but it has had the favorable consideration of economists as well as men of business, and we submit with confidence that its adoption will be attended by the most satisfactory results. We are not, of course, insensible of the fact that such a system will appear to prejudice certain interests, but we are convinced that the facilities for the transaction of the public business thus afforded will do more than anything else to establish confidence in the Stock Exchange, to the benefit of the general body of members. We think you will agree with us that if you are enabled to offer your clients the same advantages in the execution of their orders as would result from an amount of industry which would be physically impossible, it would conduce to your success, and that such a system in the hands of any outside organization would constitute an irreparable injury to the market of which you are a member. We will not enter upon the general question of the 'tape,' further than to say that it is now, as ever, the wish of the directors, in all their arrangements, to be in accord with the Stock Exchange, and to take any steps which may be held to further the interests involved."

Electric Railways.—IX.

In continuing to-day our series of articles on electric railways, we take up a branch which, although at present looked upon with distrust by many, may yet turn out to be one of the most feasible means for the propulsion of railway cars. We refer to the employment of accumulators, the stored energy of which, conveyed to a motor in the form of current, sets it in motion, and with it the car. While as yet this mode of propulsion is in the experimental state, the progress made of late has been such

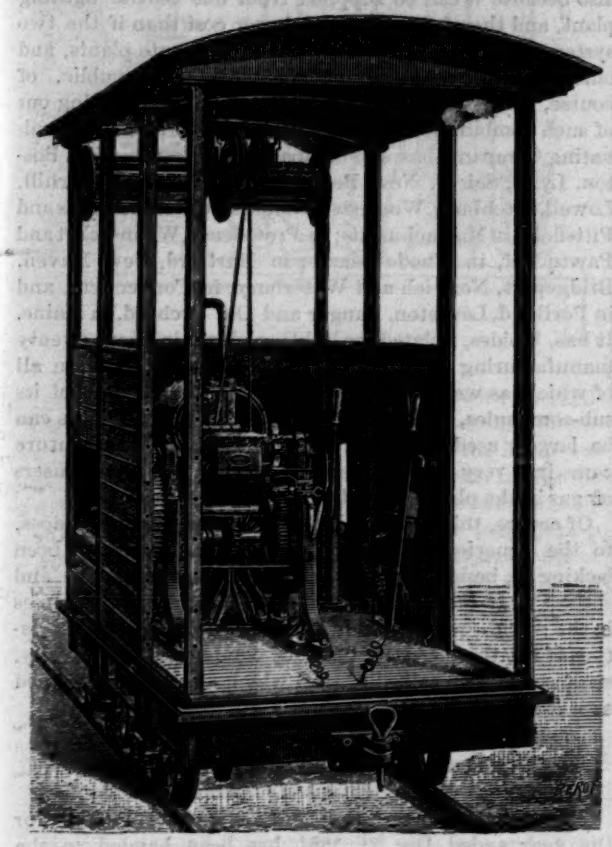


FIG. 1.

that a satisfactory solution of the problem appears to be only a matter of time; indeed, experiments that are now being made, and to which we refer later on, seem to indicate that the near future may see cars propelled by the energy derived from accumulators, with success, judged from the standpoint both of convenience and economy.

If we undertake to examine into the merits and demerits of such a system, the main argument brought forward against the use of accumulators for this purpose consists in demonstrating the large loss of power which a number of transformations entail. That a number of reducing stages have to be gone through, is obvious, for we have: I. The mechanical energy developed by the engine. II. The conversion of mechanical into electrical energy in the dynamo. III. The conversion of electrical into chemical energy in the accumulator. IV. The reconversion of chemical into electrical energy. V. The final transformation of electrical into mechanical work by the motor. Here, it will be seen, four transformations take place which must necessarily result in loss, but it remains to be shown whether by good apparatus and economical management these losses will not be reduced to a point below that experienced with other systems.

There are two of these, principally, in competition with electricity to supplant the use of horses on tram lines, and they are steam and compressed air. In comparing electricity with steam, we find two ways in which the latter can be applied, viz., by steam locomotives direct, and by an endless cable driven by a steam engine. Using locomotives, there is required a separate engine and boiler for each car or train of cars, and a consumption of fuel between 6 and 7 pounds of coal per horse-power per hour, which latter figure may be considerably exceeded where frequent stoppages occur; and to this must be added the other expenses incidental to engine-running. With cable transmission, there need be only one large engine using 2½ pounds of coal per horse-power per hour; but the cost of construction of a tunnel for the passage of the cable presents a large item which must be taken into consideration. As regards compressed air, the use of separate locomotives is necessary, and, while the engine may not use more coal than in the preceding case, the large loss of power due to the wasted heat of compression makes it a matter of doubt whether this system can be economically employed for the purpose, often as it has been attempted. Taking up our original system, all that would be required is a good central engine as in the preceding examples, and a dynamo, while each car would be supplied with a small electro-motor and storage batteries fitted into compartments in the car. Objections have also been raised with respect to the power lost in transporting the dead weight of the accumulators and motor, but even this objection appears to have been greatly lessened, so that as compared with steam and compressed-air locomotives, the former shows up quite favorably.

These are the conditions, roughly sketched, that enter into the problem, the solution of which lies in the choice between a system requiring a large original outlay of capital and one in which the cost of power or running expense is the principal item.

Looked at from the standpoint of *convenience* and *applicability*, the propulsion of tram cars through the medium of accumulators must be conceded to be second to no other. The batteries occupy no valuable space, being stowed under the seats, while the motor can be placed under the car, as shown in one of our illustrations. Adding to this the absence of smoke, dust, escaping steam and its accompanying noise, it becomes manifest that the points in favor of such a system are of a most decided nature.

While it is hardly probable that the storage battery will supplant the locomotive for heavy and continuous railway traffic, it is eminently applicable on tramways within city limits, and it is from this standpoint that we have viewed it here. We now pass on to examine what has been done towards putting the system in a practical shape. One of the instances in which it has been applied successfully is presented by the arrangement in use at a bleaching establishment at Breuil-en-Auge, near Lisieux, France. Fig. 1 shows a locomotive, the accumulators being carried on a tender which is not shown. The installation is used in France for the purpose of gathering and folding the sheets of linen which are spread out upon a meadow to bleach. The peculiar nature of the case made the use of accumulators the only method which could be applied. A steam-engine was out of the question, since the dust and smoke would injure the linen, while to lead the current through the tracks laid on a damp meadow would have entailed a large loss of current.

London, Brussels and Paris have all seen tram cars run by storage batteries in operation, and Fig. 2 represents a car which for some time ran in Paris. The illustration will give a good idea of the manner of disposal of the accumulators and motor.

One of the most recent attempts in this field, which bids fair to be carried to a successful issue, is the experiment now being undertaken by Mr. Reckenzaun, whose motor was illustrated and described in our issue of Nov. 15, 1884. Regarding the experiments, we quote the following from the London *Standard:*

Under the direction of their engineer, Mr. Reckenzaun, the Electrical Power and Storage Company have fitted a car with battery and electric motor, and have completed the interior with every comfort in the furnishing. They have, moreover, made a tramway four hundred yards long for the car to run upon. The experimental trials with it have been going on for many months, and the results have been entirely satisfactory. Indeed, the car has been passed for public service by Gen. Hutchinson, on behalf of the Board of Trade, and in a short time it may be expected to make its appearance on one of the London tramways. Accumulators have now been produced, of much less weight and far greater power than formerly, and this result is attained without sacrifice of durability. The whole series of accumulators in the present car weigh only 1¼ tons, and the motor, gearing and accessories weigh about half a ton, bringing the total weight of the motive power to 1¾ tons. The car, which has been transformed out of an old one, for many years running on the Greenwich & Westminster line, weighs 2½ tons—the modern cars on the American lines weigh only 32 cwt.—and its load of 46 passengers brings the total up to 5½ tons. Comparing the weight of this motive power with steam or compressed-air locomotives, which do not weigh less than from 8 to 10 tons, the comparison shows well for electricity. Another distinct advantage is that the electrical power can be increased when needed, as in going up steep gradients, to 16 horse-power; and the power can be diminished to one or two horses on levels, or shut off entirely on down-hill journeys. The motive power is thus expended or economized completely in accordance with the nature of the road. The car, moreover, is put on two bogies, each with four wheels, whereby the wheel base is diminished, and the cars can turn corners and encounter curves of very short radius. Another advantage of this arrangement is, that there is no such overhanging, and, consequently, no such rocking in traveling, as there is in the ordinary cars which have their four wheels placed at short distances from the centre.

The experimental line at Millwall is a difficult one. The line makes a bend of nearly a right angle, and an actual curve of 33 feet radius has to be passed. The inclines vary from a level on the portion from the shed-end to the curve, and rise thence from 1 in 40 to a gradient of 1 in 17 at the opposite termination. This steep incline has, consequently, to be faced without a run, a rush being prevented by the sharp curve intervening. The new car overcomes all these difficulties and makes its way up with surprising speed and steadiness. It has been considered very adverse to the economical use of stored electricity that so many transformations of energy had to be encountered, but the practical experience of the Millwall experiments is asserted to be that the running costs, including 15 per cent. for depreciation of machinery and 50 per cent. on accumulators, are about half the cost of horses on tram lines. The car at Millwall can be run for two hours with one charging of the accumulators, starting, stopping and reversing every minute. The used accumulators can be taken out and the car supplied with fresh charged cells in as short a time as is occupied by the changing of horses. This operation is accomplished with ease by means of a trolley fitted with rollers.

The new car, as fitted, has a very elegant and even a luxurious aspect. The accumulators are placed under the seats completely out of sight; the motor is placed under the car very neatly, and is only seen when looked for. The interior is furnished with four 20-candle power incandescent lights, and with pushes for electric bells for communication between the passengers and the conductor. The traveling is perfectly free from vibration or tremor of any kind, and is absolutely faultless in that respect. Existing rolling stock of the various tram companies, it has been demonstrated by these experiments, can be easily converted; and by the placing of the car on two bogies the average weight on each wheel is brought under one ton, so that no damage to existing light tramway lines would be incurred. Every detail, mechanical or electrical, has been well thought of and well worked out.

There is one other question—that of cost; and this appears to be equally satisfactory in its solution. The aver

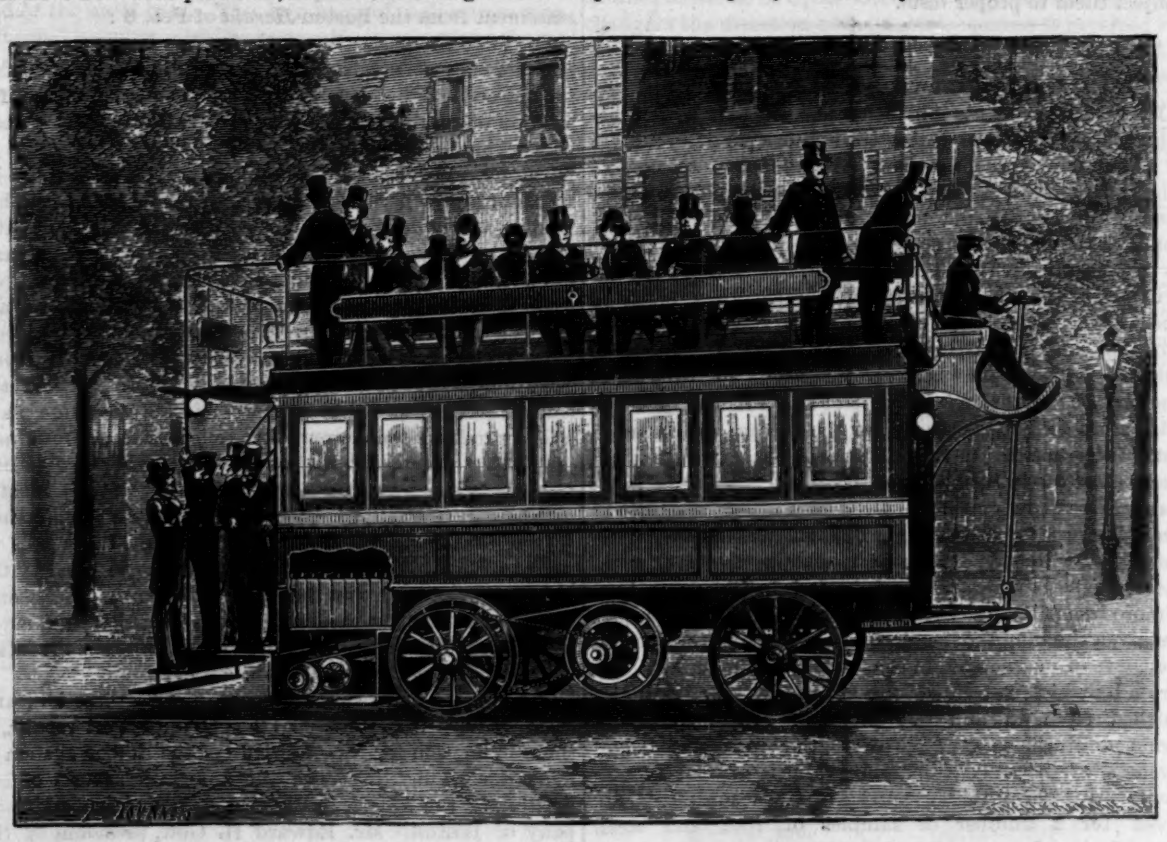


FIG. 2.

age cost of a steam locomotive-worked tramway would be £780 to £800 per car. For the electrical tramway the cost of six cars, including the charging station, would give an average of £700, and the charging station would occupy less space than the stabling of ten horses.

The above will give a fair idea of the present status of electric locomotion by accumulators, and, with the improvements that are constantly being made in the latter, the time does not appear to be distant when they will occupy a prominent position in the applications of electricity. Certain it is, that while accumulators, as now constructed, have been able to furnish one horse-power per hour for every 150 pounds of their weight, this figure is considerably less than that which theory indicates, so that the highest point of efficiency has by no means been attained as yet. In conclusion, the case of electric loco-

motion for tramways may be summarized by saying that as steam and compressed air have been tried and found wanting, there is nothing to bar the use of electricity if it can be made to do the work economically.

Magnetizing the Lodestone.

Prof. Antonio Pacinotti, the well-known inventor of the Pacinotti dynamo, has recently made some interesting experiments in magnetizing magnetite or magnetic oxide of iron by artificial means, with a view to substituting it for permanent magnets of tempered steel in the construction of dynamo-electric machines. One fact that he has demonstrated is that a piece of natural lodestone placed between the poles of a strong electro-magnet can have its magnetism changed in direction, and a stronger permanent magnetism induced. This induced magnetism may, in fact, exceed that of tempered steel. M. Pacinotti employed the magnetite of Elbe Island, and an electro-magnet of two coils, each composed of 420 turns of a copper wire 2.5 millimetres in diameter. The cylindrical cores were each 217 millimetres long and 84 millimetres in diameter. The current used was supplied by a little dynamo driven by two men, and giving about 7 ampères. Different lumps of magnetite were magnetized by this apparatus, by placing them between the poles of the electro-magnet, and M. Pacinotti found that crystallized magnetite possessed no coercive force and cannot be magnetized in a permanent manner, perhaps because of its purity and crystalline form. Even after being pressed between the poles of a strong electro-magnet a little octahedric crystal of Tyrolese magnetite and a fragment of magnetite from Traversella did not preserve any trace of permanent magnetism. Granular magnetite, however, which forms the body of natural magnets with armatures, possesses a notable coercive force. After having been placed between the opposite poles of a strong electro-magnet it preserves in a permanent fashion the artificial magnetism communicated to it, a magnetism which may be much stronger than its natural magnetism, and may even exceed that of tempered steel, weight for weight. M. Pacinotti has therefore come to the conclusion that owing to the high cost of good steel magnets, the fine-grained lodestone may be used instead for small magneto-electric machines, worked by hand, always supposing that its magnetism is reinforced by artificial means. Mr. Bosanquet, of St. John's College, Oxford, has made a series of careful observations on the magnetism of hard-steel permanent magnets made last February, and found it to be subject to a gradual decay or loss of power. In seven months the magnetic moment of a number of these magnets diminished in the ratio of 12 to 11, and Mr. Bosanquet therefore recommends those who employ such magnets to subject them to proper tests.

Experimental Researches in Magnetism.*

BY PROF. J. A. EWING, B. SC., F. R. S. E.

In these experiments the author showed that by vibrating a piece of soft iron during the application and removal of magnetizing force, the iron is then found to possess almost no retentiveness. But when the application and removal of magnetizing force are effected without mechanical disturbance, the retentiveness of soft iron is found to be even greater than that of steel. In some cases 93 per cent. of the whole induced magnetism of a piece of annealed iron was found to remain on the complete removal of the magnetizing force. It is pointed out that there is no discrepancy between this result and the well-known fact that a *short* iron core of an electro-magnet retains almost no magnetism when the current in the magnet is interrupted. In that case the ends of the magnet itself, after the interruption of the current, exert a sufficient reversed magnetizing force to destroy almost entirely the residual magnetism. But when tested under the conditions which give uniform magnetization and avoid the demagnetizing influence of the ends, soft annealed iron is more retentive than even the hardest steel. Examples are given showing that the influence of permanent set in the curve of magnetization is so marked as to give a criterion by which a strained piece may be readily distinguished from an annealed piece of metal, and that strain diminishes very greatly the magnetic retentiveness of iron. Numerical values of the coefficients of permeability and of susceptibility are given for a number of samples of iron and steel. The effects of stress (consisting of longitudinal pull) on the magnetic susceptibility and retentiveness of iron are also dealt with, and the subject is taken up in two different ways. In one the magnetic effects are observed when a load hanging from the wire under examination is gradually applied, removed, and otherwise varied, the wire being then either kept in a magnetizing field of constant value or freed from all magnetizing force. In the other method the load is kept constant, and magnetizing force is applied, removed, and otherwise varied. The two methods give results which would be identical were it not for (1) hysteresis (static lagging action of magnetism) in the relation of magnetism to load in a constant field, and (2) hysteresis in the relation of magnetism to field under constant load. The relation of magnetism to varying load in a constant field is examined at great length, both in soft annealed wire and in wire hardened by stretching, and the effects, which are very complex, are exhibited graphically. They also afford an easy criterion by which a stretched piece can be distinguished from an annealed piece, and, both in stretched and annealed metal, they exhibit static hysteresis, which can be more or less completely wiped out by mechanical vibration. The connection of the author's present work with the earlier results of Villari, and the extensive researches of Sir W. Thomson, is pointed out. Numerous curves are given, which show very clearly the position of what Thomson has called the "Villari critical point," or point at which the sign of the effect of stress on magnetism becomes reversed; and it is shown that this reversal is associated rather with a particular value of magnetization than with a particular value of magnetizing force, the same reversal being found to occur when the magnetism dealt with is wholly residual. Instances are given of very curious molecular reminiscences of previous loads which were found to exist even when the previous loading had been performed at a time when the metal was entirely destitute of magnetism, although the loads whose effects were found to remain were much less than loads previously applied to the same wire, and were consequently unable to produce mechanical change of any ordinary kind. These residual effects of former loads became visible on the next magnetization of the piece. It is shown that these effects of previous loads can be almost obliterated by subjecting the wire to vibration before beginning to magnetize it. The ratio of residual to induced magnetism in soft and hardened iron and steel has been examined for various degrees of magnetization, with the result of showing that the ratio passes a maximum when the magnetization is moderately strong, and then falls off as the state of so-called saturation is reached. The influence of the presence of stress on this ratio and on residual magnetism generally has also been investigated. Careful experiments on both induced and residual magnetism have led the author to conclude that (within the range dealt with by him) there is no perceptible hysteresis in the relation of magnetism to temperature. Curves are also given exhibiting the process of magnetizing the same piece at different temperatures. These cross each other in the same manner as the corresponding curves for different values of stress, a fact to be anticipated from the earlier discoveries of Baur.

*Abstract of paper read before the Royal Society, Jan. 8, 1885.

Electric Light Combinations in New England.

For some time past reports have been in circulation with regard to electric light combinations in New England, and one rumor has had it that the American Electric and Illuminating Company would "make a deal" with the Edison companies. It appears that a plan of co-operation has been arrived at, and the position is given in the following statement from the Boston *Herald* of Feb. 8:

For some time past the conviction has been growing in the minds of the electric arc light, as well as the electric incandescent light, people that sound economy called for a union or combination of the two systems—that, instead of working in opposition, they should work together in harmony. For it is quite evident that each system has its mission; and where one might be unsuitable, the other would exactly meet the necessities of the case. Again, there are very many places, as in cotton, woolen and other mills and manufactories, where a mixed system is called for, where now, in addition to arc lights, gas has to be used in some sections, rooms or offices. Now, if the electric lighting company that now furnishes the arc lights for such establishments could furnish the smaller incandescent lights as well, from the same plant which produces the current for arc lighting, it would not only be an economy to the corporations using the lights, but it would be a greater safety as well as a much greater satisfaction to them, for once people become accustomed to the electric light—arc or incandescent—they can no more go back to the use of gas than gas-users can to the old tallow-candle dip or the whale-oil lamp. The Brush and the Weston companies have realized this and acted upon it, the former securing the Swan lamp, and the latter a lamp invented by Mr. Weston.

The newest departure, however, in this direction, and one that will undoubtedly give very important results, is the combination for New England of the Edison system of incandescent lighting with the American system of arc lighting of the American Electric and Illuminating Company of Boston. Mr. Edward H. Goff, president of the latter company, on its behalf, has, within a few days past, closed an important contract with the Edison company for isolated lighting, by which his company is to have the exclusive right of using the Edison system of isolated lighting in connection with all its arc light stations in New England, as well as with its isolated plants in the same territory. The Edison company, with which the arrangement has been made, has the exclusive right for New England of putting in isolated installations, such as the ones now in the *Herald* and *Advertiser* offices, and other places in Boston and New England, where they are giving the best satisfaction. There is still another branch of the Edison parent company in Massachusetts, which also covers New England. This branch, or agency, is for the purpose of organizing companies, like that at Brockton, to light cities by the Edison underground wire system, as is now carried out in New York and elsewhere. Mr. W. L. Garrison, of Boston, is the agent of the Edison Electric Light Company, and with him Mr. Goff has made an arrangement by which a close alliance will be consummated to organize companies similar to that at Brockton, and establish a system of lighting cities and towns—where the same is called for—using the incandescent system for house-lighting chiefly, and factory-lighting where suitable, and employing in connection with it the American arc light for general factory, store, street and public square lighting.

This combination is an important one, not only because both kinds of light can be furnished by one company, but also because it can be supplied from one central lighting plant, and therefore at a much lower cost than if the two systems existed side by side, having separate plants, and officers, employés, etc., of their own—the public, of course, being the gainers from the economies growing out of such combination. The American Electric and Illuminating Company has sub-companies in Boston, East Boston, Lynn, Salem, New Bedford, Fall River, Haverhill, Lowell, Fitchburg, Worcester, Gloucester, North Adams and Pittsfield, in Massachusetts; in Providence, Woonsocket and Pawtucket, in Rhode Island; in Hartford, New Haven, Bridgeport, Norwich and Waterbury, in Connecticut, and in Portland, Lewiston, Bangor and Old Orchard, in Maine. It has, besides, isolated arc lighting plants in about twenty manufacturing companies' mills in New England, in all of which, as well as in connection with the business of its sub-companies, the Edison incandescent electric lights can be largely used, and will, no doubt, in the near future come into very extensive employment by the present users of gas in the places named.

Of course, this new combination—supplying, as it does, to the American company what it has heretofore been lacking in, beside allying it with the most powerful and successful of the incandescent electric lighting companies in the world—will preclude any prospect of a consolidation of the three electric lighting companies in this city, such as has been talked of, and which at one time seemed as if it might be consummated.

Report of the Commissioner of Patents.

The annual report of the Commissioner of Patents for the year ended Dec. 31, 1884, has been handed to the Secretary of the Interior. That part of the report which relates to the finances of the bureau shows that there was received during the year from all sources $1,075,799 and that there was expended $970,580, an excess of receipts over expenditures of $105,219. The report shows that there is in the Treasury of the United States a balance on account of the patent fund of $2,781,695. A summary of the work of the office for the year shows that there were issued 20,297 patents and designs; that 110 patents were reissued, and that 1,021 trade-marks and 573 labels were registered; 12,301 patents expired during the year, and patents were withheld in 2,839 cases for non-payment of the final fee. Of the patents issued, 19,013 were to citizens of the United States, and 1,284 to citizens of foreign countries.

The Commissioner again calls attention to the inadequacy of room and of facilities for conducting the business of the office, and to the unfitness of the rooms now used for occupation by human beings, and says that several deaths have already occurred from disease contracted in the foul, damp rooms. He also calls attention to the insufficiency of the facilities for conducting examinations, and recommends that an appropriation be made for a laboratory and such appliances and fixtures as are necessary. He asks that the force of examiners be largely increased, stating that the present force is inadequate. In connection with this matter, he says: "That those having business with the office have paid to the government funds ample to provide everything essential to the prompt and proper dispatch of business, including increase of room, increase of force, and additional facilities, is certain, and I respectfully submit that it would be difficult to find a satisfactory reason for withholding the fund from the use for which the government received it, to wit, to pay the expense of a prompt and proper disposition of the business brought to the patent office." In reciting the evil results of the inadequate means at his command to further the business of the office, he says, "Many important interests are lost or greatly damaged by reason of the inability of inventors to have their applications disposed of within a reasonable time." The Commissioner recommends various increases of salaries of examiners in the office, and that the salary of the assistant commissioner be increased to $4,000 per annum.

A Sounder Basis Wanted.

A young Bostonian, who recently went up among the hills of Vermont to get married to a farmer's daughter, was taken to task by the old man as follows:

"Now, Jeems, this 'ere match was kinder brought about by you and Susie, and I've had no chance to say anything to you. How much are you worth?"

"Well," replied James, after some hesitation, "putting it on the basis of Western Union at 57, I am worth $30,000."

"Stop! young man—stop right thar!" exclaimed the old man. "I want a sounder basis than that! Jist figger on turnips at 75 cents a bushel and see what your value amounts to!"—*Wall Street News.*

A Chronological Record of Expiring Electric Motor Patents.—III.

BY F. B. BROCK, WASHINGTON, D. C.

In 1852 John S. Gustin, of Trenton, N. J., constructed an electric motor arranged for operating a pump.

We give illustrations of the Gustin motor—a side and an

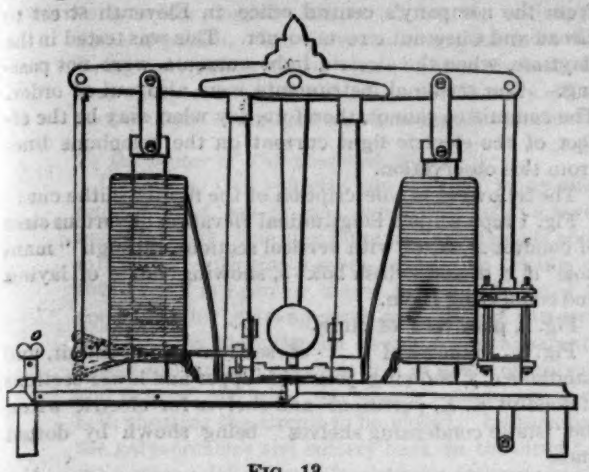


FIG. 13.

end elevation (Figs. 13 and 14). In connection with the oscillating beam shown is a pendulum arm extending downward and carrying a weighted ball. At the lower extremity of this pendulum is a projection which moves the valve, alternating the battery current on the magnets by the vibrating motion of the pendulum. The pendulum is intended to move between two spring-buffers at either end of its throw, which are designed to relieve the force of the blow of the pendulum, and also to assist in reversing its motion. On the valve or break-piece is a conducting plate, its length so adjusted that it can form a connection with but one side at the same time. The negative wires from the helices are both led to a like strip of copper on the opposite side of the bed-plate.

At either end of the oscillating beam are pivoted links which connect or suspend the armatures of the magnets. The arrangement of the pump is shown at one side of the device, its piston-rod being connected with one end of the working-beam. At the opposite end of the beam is a long depending link which is pivoted at its lower end to a regulating spring. One end of this spring is securely fixed in the frame.

A thin piece of rubber cloth is arranged on the magnet poles to prevent the adhesion of the armature to the magnets when the battery current is broken, and also to prevent violent concussion of contact.

The regulating spring is adjusted in its tension in this machine so that it will require twenty pounds force to move it one inch to the point of extension (shown by dotted lines) with the rod from the working-beam, and so set as to be at rest when the pendulum is central. The object of the regulating spring is to receive the excess of power of the electro-magnets when they are closing and to give it off when they are too far extended for the attractive force to be available. With the assistance of the pendulum and this spring, nearly an equal force is said to be exerted throughout the stroke of the pump.

Gustin states that the tension of this regulating spring should be fully equal to the power required to move the pump when the spring is at its extreme point of action. At that point the electro-magnets of the Gustin motor have

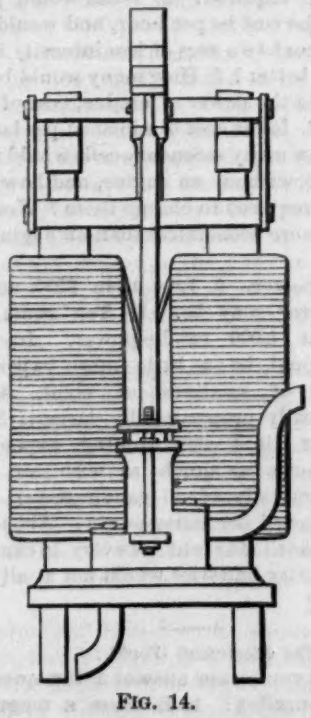


FIG. 14.

so feeble a force that the spring has nearly the whole work to perform.

In the same year Gustin devised another electro-magnetic motor.

The legs of the magnets of this motor were nine inches long and cylindrical, the armatures were of the same length and form, and were adapted to move longitudinally in the helices which projected beyond the poles of the magnet, forming a hollow core. Five magnets were employed and ten armatures, there being an armature to each pole of the magnets. Adjusting nuts were employed to secure the armatures in different relative positions on their supporting rods.

The armatures of one magnet of the series were arranged to allow of a play of one inch, the armatures of the next magnet having a play of two inches, and so on. Upon the energization of the series the magnet whose armatures have the play of one inch are the more powerfully attracted, upon which the current is broken on that magnet and closed upon the next magnet of the series. A like result is produced successively upon all the magnets of the series until they have all performed their work. The stroke of the working beam is not yet complete, however, when the fifth pair of magnets close. One series of magnets having performed their work, the other series, working in connection with the opposite end of the working-beam, is in readiness to perform its work in like manner.

The motion of the working-beams is communicated through their bearing-rods to the crank and fly-wheel, thereby producing rotary motion.

Chas. G. Page, of Washington, D. C., in 1854 constructed what was for that time a novel and ingenious electric motor (Figs. 15 and 16).

This motor resembles in external appearance, to some

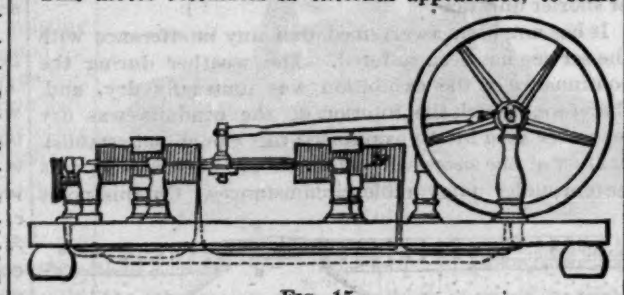


FIG. 15.

extent, a double-action, slide-valve steam pump. This Page motor comprises two parallel axial bars working through two pairs of helices, and two fixed armatures arranged at either extremity of the parallel bars. The pit-

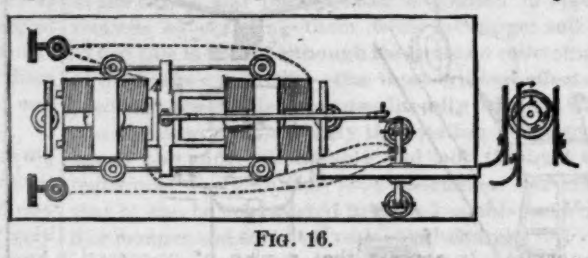


FIG. 16.

man rod connects the crank of the fly-wheel to the cross-head of the axial bars. The two pairs of helices are each connected by wires with the two conducting springs shown in the detail view, each bearing alternately against the

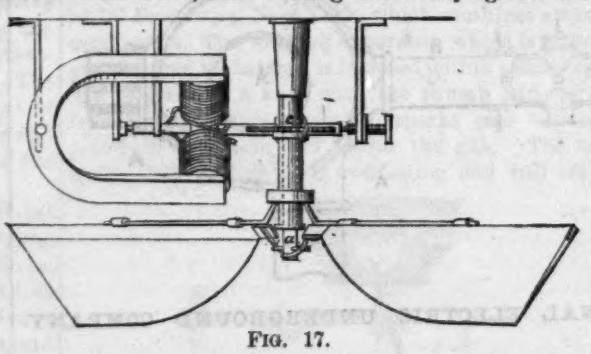


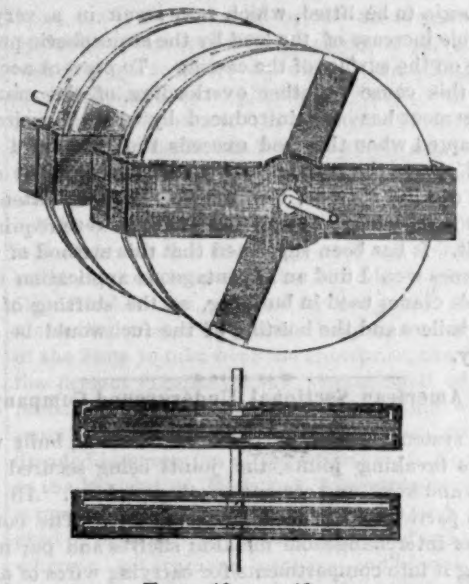
FIG. 17.

cut-off on the fly-wheel shaft. This connection is made by means of the wires passing down under the base-board and up through to their respective connections, as shown by the dotted lines. This fly-wheel cut-off or commutator consists of two semi-cylindrical metallic segments insulated from each other and secured to a cylinder of wood upon the shaft. An entire metallic ring is fixed upon a part of the wooden cylinder of less diameter than that to which the insulated segments are attached. This ring is connected by a strip of metal with one of the metallic segments. The three conducting springs are shown in position in the detail view.

The spring in contact with the smaller ring connects with the positive pole of the electrical energy, and the current will therefore pass through the metallic connections to the spring at the left-hand side of the detail figure. This latter spring is connected with one termination of the helices to the left of the drawing, the other being connected with the negative pole. The commutator revolves in the direction of the arrow. The axial bars are shown with thin poles passed entirely through the helices and within the influence of the armature. The instant the dead point is reached, the other pair of helices is charged to propel the frame of axial bars in the opposite direction. This is effected by the revolution of the commutator in the direction of the arrow, the metallic segments being reversed.

The very short distance through which magnets act with power, and the rapid diminution of power as the magnets recede from each other, present serious practical difficulties in electro-magnetic engines, whether in the reciprocating or rotary form. Dr. Page asserts that by the employment of a reciprocating core arranged to move in the line of its length through an arrangement of helices, the magnetic power can be made to act with more uniformity through a considerable distance, as some portion of the magnetic core is always in close proximity to the helix.

In the latter part of 1854, Louis Stein devised an electric



FIGS. 18 AND 19.

motor for operating a revolving fan (Fig. 17). The device is intended to be attached to the ceiling. The main pendent vertical shaft carries the wings of the fan. This shaft has a worm-wheel keyed to it, and to the armature-shaft of the electric motor is affixed a worm which meshes with the worm-wheel and revolves the fan. The electro-magnets are arranged at equal distances apart around the horizontal shaft. Armatures are arranged at suitable distances around the series of electro-magnets, so that when the battery is in action the shaft is kept in motion and the fan revolved. This patent of Stein seems to be more an application of the electric motor than an improvement in the motor itself.

The electric motor of Maurice Vergnes (Figs. 18, 19 and 20) comprises four wheels or discs composed of wood and revolving upon a common axle. Each disc includes an electro-magnet arranged thereon diametrically on both sides of the disc, so that the magnets are parallel. Each pair of the magnets communicates with a separate battery and revolves in a peculiarly arranged "multiplying coil," the coils being side by side and parallel to each other. There are two of these multiplying coils, which communicate with separate batteries, which, together with the separate batteries requisite for the electro-magnets, make in all four distinct batteries of equal intensity. By means of pole-changers the direction of the electric current is reversed in the multiplying coils at every half revolution of the wheels, and in each pair at the moment when the other pair is exerting its greatest force. The conductive power of the multiplying coil is said to be equal to the conductive power of the electro-magnet revolving therein.

By referring to the drawings it will be seen that the magnets are straight bar magnets and that the multiplying coils or helices form an inclosing horizontal band through which the discs and their magnets revolve. The currents in the two multiplying coils are reversed alternately so as to produce a continuous revolution of the electro-magnets without any change in their polarization. The commutator is arranged on the shaft between the two pairs of rotating, magnet-carrying discs.

(TO BE CONTINUED.)

A 20-Ton Electric Crane.

Electricity has recently been applied to the working of cranes, and the latest example is that of a foundry crane at the works of M. Farcot, at St. Ouen, France, the crane having previously been worked by hand.

The generating dynamo is at a distance of about 100

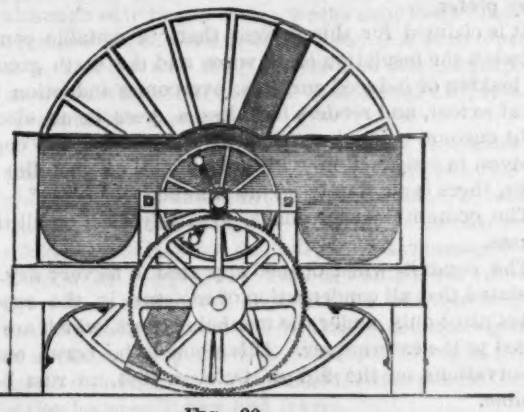


FIG. 20.

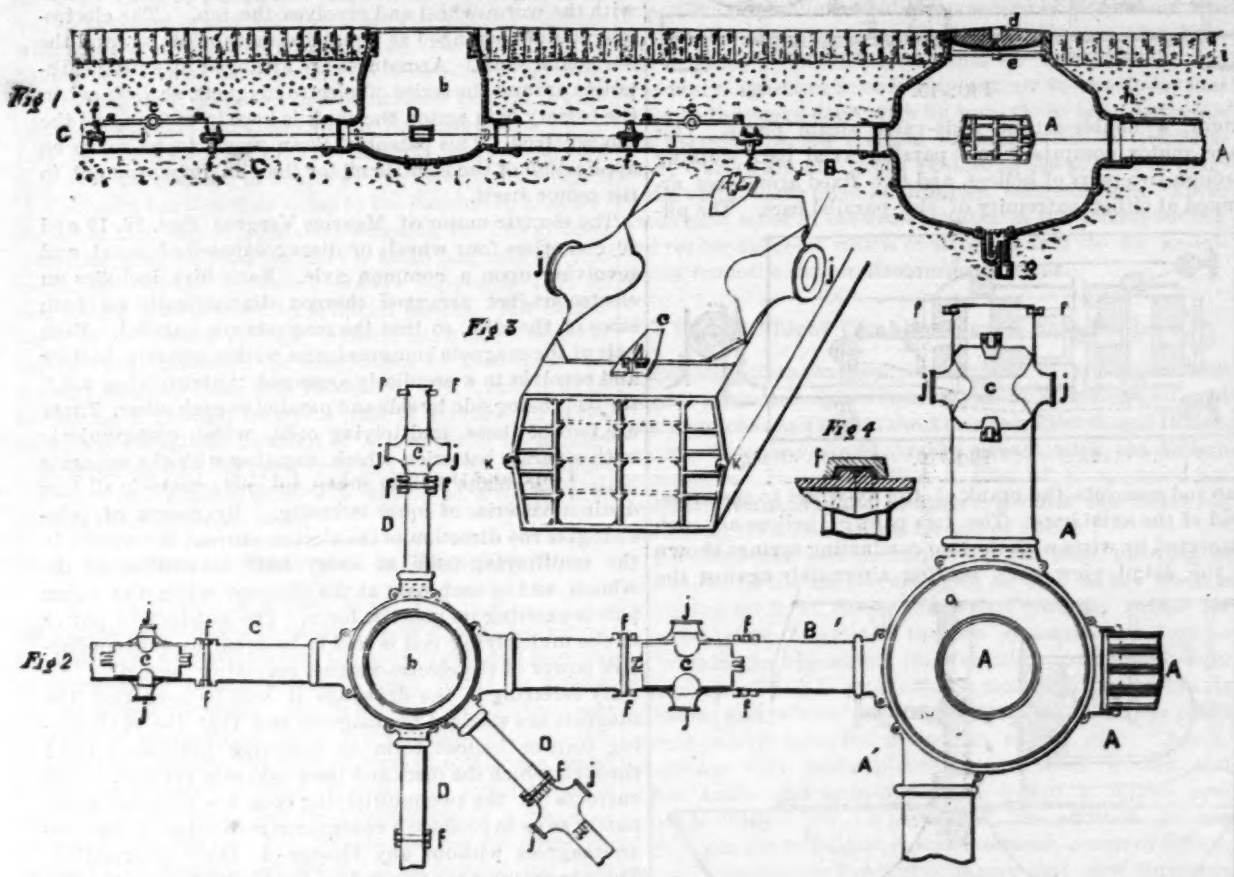
yards from the crane. At the speed of 1,550 revolutions per minute it produces a current of 13 ampères and about 350 volts. The secondary dynamo is fixed upon the crane itself, and makes 1,000 revolutions per minute, developing about four horse-power. The crane gearing itself has not been altered, and the electric machinery has been so fixed that the crane can also be worked by hand when the steam engine is stopped. A special rheostat allows progressively increasing resistances to be introduced up to 60 ohms, by

means of which the lifting speed of the crane can be varied. A Mégy brake, acting by centrifugal force, assures safety in case of accidental derangement of the machinery. When drawing large castings out of the sand, a vacuum is produced under them at the moment they begin to be lifted, which may result in a very considerable increase of the load by the atmospheric pressure acting on the surface of the casting. To prevent accidents from this cause or other overloading of the crane, an arrangement has been introduced by which the circuit is interrupted when the load exceeds the prescribed limit, and of course the crane comes to a standstill. The crane, which can lift 20 tons, now requires only the attendance of one man, while formerly ten laborers were required to work it. It has been suggested that this method of working cranes would find an advantageous application to the movable cranes used in building, as the shifting of their steam boilers and the hoisting of the fuel would be saved thereby.

The American Sectional Underground Company.*

This system consists of cast-iron conduits, built up in sections breaking joints, the joints being secured with clamps and keys, and cement or other packing. All parts of each particular size are interchangeable. The conduit contains interchangeable metallic shelves and partitions, dividing it into compartments for carrying wires of different kinds.

Three sizes of conduit were exhibited, each being connected to a manhole placed at every street corner, into which one or more men can enter for the purpose of hauling in the wires, making the necessary connections, etc. There are further, at convenient distances along the line



CONDUIT SYSTEM OF THE AMERICAN SECTIONAL ELECTRIC UNDERGROUND COMPANY.

of conduit, handholes for tapping the wires for house-to-house supply. As the position of these is accurately known, by opening up a few stones in the pavement, a wire or wires can be tapped for house supply. This is effected by running the wires required from the nearest manhole on the upper or local shelves.

Different companies can be supplied with separate compartments, and they can employ any particular insulation they prefer.

It is claimed for this system that "a metallic contact between the insulation of all wires and the earth grounds all leaking or induced currents, overcomes induction to a great extent, and renders harmless a cross in an electric light current. Further, that by the use of the copper shelves, in conjunction with telephones on metallic circuits, there is absolutely no interference whatever."

The committee was unable to satisfy itself on all these points.

The conduit when opened appeared to be very dry. It is stated that all condensation of moisture in the conduit takes place only under the manhole covers, which are exposed to the external air. This seems to be borne out by observations on the 9th of October, 1884, no rust being visible.

This system seems to meet, in a very complete way, the question of house-to-house supply; separation of wires; facility of laying; repairs, and future expansion. It is not necessary to lay the wires in the conduit until absolutely required. It would, however, be necessary to use first-class insulated wires, as it would not be possible to keep such a conduit absolutely dry. Some provision will also have to be made for passing off gas, which tends to accumulate in the main, and might be set on fire and prove dangerous. It is estimated that the *A* conduit, 10 inches by 15 inches, would cost $15,000 per mile, the *B* conduit, 6 inches by 10 inches, $10,000, and the *C* conduit, 5 inches by 8 inches, $5,000. The *A* size of conduit, which is laid in Chestnut street, Philadelphia, from Third to Broad (equivalent to Fourteenth) street—(about a mile in length)—is estimated to accommodate 3,000 wires. The *B* size is laid in Tenth, Eleventh and Brown streets, and its capacity is for about 1,200 wires.

By means of the large manholes and separate compartments, the wires in use can be at any time taken out, replaced by others, or inspected and put back, in the shortest time and with no derangement to the pavements and streets. The size of the conduit also enables one to lay a very large number of wires. The prevention of induction would seem to be about equal to that in all systems employing iron-cased ducts, with the additional advantage of interior metallic screws and copper shelves, all well grounded, so that no current in one compartment would be likely to have any influence on those of another.

The conduits were laid down along Chestnut street in October, 1883, and the electric light service has been continuous since the latter part of December of that year, which period included a number of severe storms of longer or shorter duration.

It has not been ascertained that any interference with the service has been suffered. The weather during the continuance of the exhibition was unusually dry, and, therefore, though the interior of the conduits was dry wherever seen by the examiners, this would not establish the fact of the successful exclusion of moisture by this system under unfavorable circumstances. On this point they have been compelled to take the testimony of the officers of the company and the statements of the subscribers as to the success of the conduits for the electric light wires.

Few, if any, telegraph or telephone wires were in the conduits, and as it is with these that the defects of any system would be best observed, the examiners have no sufficient data for expressing an opinion.

It is the intention to introduce the insulated telegraph and telephone wires loosely, or without casing, unless there be a long distance in which no service is ever to be made. Under these circumstances the company proposes to use a cable. Otherwise the wires are to be laid loosely over each other in their various compartments.

A question which is intimately connected with the conduit itself is that relating to the exclusion from it of foreign matter, and especially water. [The company has suffered from gas in its conduits, and on one occasion an explosion ensued in a manhole near the State House, but this latter caused no serious damage, and it is not thought likely that there are many localities where these conditions of gas waste under the streets are likely to be similar.]*

In the streets of a city where there were great differences of level, any considerable break in the conduits which would permit the influx of a large body of water might (if the latter found free path) do considerable damage. This is an objection applicable to all hollow conduit systems.

Open gratings have been employed to permit the waste gas to dissipate itself, and these gratings have often remained open during both snow and rain storms without introducing moisture into the main conduits, the water escaping by a trap at the bottom of the manhole.

* Report of Board of Examiners, Section 18, Underground Conduits, International Electrical Exhibition, Philadelphia.

* This report was completed on October 30, 1884.

So far as the renters of light are concerned, there is not the least danger of the introduction into their houses of water or gas from this company's conduit, inasmuch as the electrodes are hermetically sealed in a gas-pipe which leads them from the handhole.

A telephone wire is laid down in the conduits, leading from the company's central office in Eleventh street to Broad and Chestnut streets corner. This was tested in the daytime, when the electric light currents were not passing. The terminal instruments were also out of order. The committee cannot, therefore, say what may be the effect of the electric light current on the telephone lines from this observation.

The following is a description of the figures in the cut:

Fig. 1 represents a longitudinal elevation of various sizes of conduit *A*, *B*, *C*, with vertical sections through "manhole" *d*, *e*, *g*, and "flush box" *b*, showing mode of laying and connecting them.

Fig. 2, plan view of same.

Fig. 3, isometrical of section of *A* conduit, and handhole *c*, *j*, showing joints of upper and lower sections of conduit *K*, *K*, partitions and shelves for electric wires, the "static condensing shelves" being shown by dotted lines.

Fig. 4, transverse section through top of clamp, showing section of ends of conduit and packing at joints.

The letters show similar parts in the different figures, *A* being the largest size conduit yet made, capacity about 3,000 wires, *A'* showing the conduit opening in manhole when connection is made at one side of manhole or flush-box. *B*, *C* and *D* are consecutively smaller sizes of conduit; *a*, manhole; *b*, flush-box; *c*, handhole; *d*, manhole and flush-box cover, made either solid, or perforated for ventilation; *e*, bar with which to fasten cover by aid of bolt and nut; *f*, clamp and keys by which the different sections of the conduit are connected; *g*, trap for drainage of any water which may collect in the manholes and flush-boxes from rain or condensation, and which may be connected with sewer; *h*, street-bed, earth and gravel; *i*, street paving; *j*, handhole opening for house connections; *k*, longitudinal joints between upper and lower sections of conduit, to be filled with any suitable packing to exclude moisture, etc.

Some Questions Answered.

To the Editor of The Electrical World:

Dear Sir: Will you be so kind as to answer the following questions? 1. Where can I purchase paper which is sensitive to an electric current, so as to make a mark when placed between two contact points of an electric armature? 2. What chemicals, and the relative quantities of each, will make a solution to thus prepare paper—to respond to the weakest current of electricity from a local battery? 3. What kind of a local battery is best to use for good effect? F. B. J.

[1. See in advertising columns the advertisements of dealers in chemicals. 2. The prepared paper is made by soaking it in a mixed solution of potassic iodide, 48 parts; starch, 4 parts; and water, 192 parts, by weight. 3. See advertising columns, where several are advertised. One cell is sufficient.]

To the Editor of The Electrical World:

Dear Sir: Please give me information on the following points: An ordinary drug store (open till 11 P. M.) burns four gas lights costing $6 per month. The druggist would like to have an arc light in place of gas: 1. What power engine would be required? 2. What would plant cost? 3. What would the cost be per hour, and would it be practical? 4. How about two arcs of less intensity? 5. Would incandescents be better? 6. How many would be required? 7. What should be the power of engine, cost of plant, and cost per hour? 8. Is the cost diminished per lamp if more are used? 9. How many secondary cells would be required if you want to do without an engine, and how many batteries (bluestone) required to charge them? Would secondary batteries be more economical than an engine?

O. B.

[1. One horse-power. 2. Less than $200, according to who the contractor may be. 3. Ten cents an hour, with a lamp at 1,000 candle-power. It would be practical, but would be a little more expensive than gas, an account of smallness of plant. 4. The cost would be practically proportionally larger. 5. For the same amount of light the running expenses would be about five times as much as with arc lamps. 6. Each lamp is generally of 16 candle-power. 7. Eight lamps may be allowed per horse-power. About the same as for arc lamp plant. One cent for every 16 candle-power. 8. It is. 9. Secondary batteries would not at all be suitable for your purpose.]

To the Editor of The Electrical World:

Dear Sir: Will you please answer a few questions that are to me very puzzling? 1. Is there a magnet known to electricians that, contrary to an electro-magnet, will attract its armature where no current is put on, and will release its armature when a current is on? If so, are they made by winding a permanent magnet? 2. Is not something similar used in telephones (Bell's patent)? 3. Granting such a magnet, how large would its core and helix be to sustain one pound, and what battery power necessary to release it? L. A. L.

[1. Yes. 2. The part of the telephone you refer

to consists of a permanent magnet which, when set into vibration by air or other impulses, generates a vibrating current in a wire coiled about the permanent magnet. 8. Core, 2 inches diameter and 8 inches long, and made of the best and hardest steel; No. 20 copper wire wound the total length of the core in forty layers; battery, three cells of the ordinary bichromate of potash. The permanent magnet is in danger of being reversed as to its poles, so that the best and surest and cheapest way of obtaining the relative effects is by means of the combination of a spring and electro-magnet.]

To the Editor of The Electrical World:

DEAR SIR: Can you or some of your many subscribers explain what has to me been somewhat of a mystery for nearly a year? One of my circuits (arc light) is about eight miles long, with thirty-seven lamps. In testing to see if the circuit is open or closed before starting, I loop in a good detector galvanometer with strong battery. I find no deflection, showing the circuit to be apparently open. I then substitute a magneto bell in place of galvanometer and battery, and give the crank a turn, which rings the bell, showing the circuit to be closed. I immediately put the galvanometer and battery back in the circuit, when I get a strong deflection. It virtually amounts to this: After finding the circuit open, according to the galvanometer, I close it by ringing the magneto bell. After putting the galvanometer in circuit, I have many times waited for ten or fifteen minutes to see if the needle would swing, but it would not until I had first used the magneto bell. I have never experienced the trouble on any of my other circuits. Very respectfully, CALIFORNIA.

The Wimshurst Electric Machine.

The accompanying illustration, for which we are indebted to *Engineering*, represents a remarkable electro-static induction machine, which attracts attention not only on account of its size, but also from the novelty of construction. Mr. James Wimshurst, the inventor, has designed and constructed a number of new forms of induction machines, and this, his latest effort, was constructed for and presented to the Science and Art Department at South Kensington. The machine is, it is said, the largest of its kind in the world. The diameter of the circular plates in this machine is 84 inches, and they consist of discs of plate glass three-eighths of an inch in thickness, and weighing 280 pounds each.

Each of these discs is pierced at its centre with a hole 6½ inches in diameter, and is firmly attached to a gun-metal boss 15 inches in length, carrying the disc at one end and a pulley at the other, and which is bored so as to run freely on an iron tube 3 inches in diameter, this tube being supported at each end by strong oak trusses, rising from a firm base, also of oak, and which is fitted with lockers at each end, for holding spare parts and accessory apparatus. The heads of the two trusses, or A frames, consist of massive castings of gun-metal, which are so shaped as to hold the hollow iron tube and the ebonite rod to which the collecting combs and discharging terminals are attached. The iron tube projects at each end beyond the trusses, and to the projecting ends are attached the brass "neutralizing" rods, which terminate in light wire brushes, shown in the illustration.

To the discs, which are well varnished with an alcoholic solution of shellac, are attached, at equal angular distances apart, radial sectors of tinfoil, sixteen on each disc. These sectors are 19 inches long, and have a mean width of 1.65 inches, thus having an area of 31.35 square inches. There is thus on each plate a metallically coated area of 500 square inches, or 1,000 square inches on the two discs together.

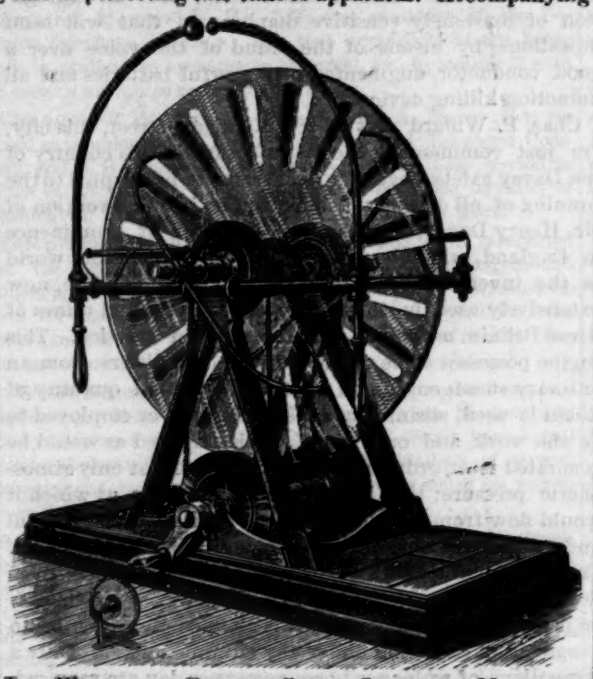
Considering the action of the apparatus it may in principle be regarded as "Nicholson's revolving doubler," the sectors on the one disc acting as inductors on the other, and *vice versâ*, and that the extraordinarily high efficiency of the machine is probably due to the fact that both plates contribute charges of electricity to the collecting combs, and that the sectors on the one disc act as inductors and as carriers respectively to those on the other when they approach the best positions for those respective actions to take place.

The two discs are rotated in opposite directions by the lower driving gear shown in the figure; this consists of a horizontal spindle fitted with a winch handle at each end, and carrying a pair of oak pulleys which are connected respectively to the two pulleys attached to the discs by endless cords, one of which being crossed, causes one disc to be rotated in the opposite direction to the other; and as the height of the bearings of the lower spindle is adjustable, the driving cords can always be maintained perfectly tight.

The principal characteristics of this form of electro-static machine, and to which its exceptionally high value as a laboratory instrument is due, are (1) that it is readily self-exciting in almost every condition of the atmosphere; (2) that the polarity of the apparatus never changes, as it is so liable to do in other forms of induction machines; (3) that the charge is very large compared with the area of the glass employed in the discs, and (4) the small cost at which the machine may be constructed.

Although the great machine which we illustrate was working in a workshop in which there was a steam engine and boiler at work, and consequently with a considerable quantity of water in the atmosphere, and although it was closely surrounded with lathes and shafting and other metallic conducting bodies, not only did it pick up its charge even before a complete revolution was made, but kept up a constant stream of discharge sparks over 14 inches in length between its terminals.

Mr. Wimshurst has in his laboratory what is probably the largest collection of the most powerful electro-static induction machines in existence, having worked for several years in perfecting this class of apparatus. Accompanying



THE WIMSHURST ELECTRO-STATIC INDUCTION MACHINE.

the illustration there is a sketch of what is perhaps the simplest and the cheapest electric-influence machine ever constructed. This little apparatus consists simply of two discs of varnished glass 12 inches in diameter, fitted with tinfoil sectors, and mounted on a spindle, which can be held in the hands, and the discs can be rotated in opposite directions by spinning them with the finger and thumb. When this is done—although there are no collecting combs or discharge conductors—the most brilliant effects can be produced, the whole apparatus literally bristling with electric discharges immediately the rotation commences, and one of the most remarkable and not the least valuable features of this beautiful little instrument lies in the fact that it can be constructed in a good salable and workmanlike manner and sold at a very small charge.

The "Dynamo" Gas-Lighter.

The above is the name of a new portable gas-lighter recently brought out by the New York Electric Company, of 737 Broadway, New York, which combines a number of good points. The working apparatus, which is quite simple and requires no battery, is inclosed within a short cylinder, and by pressing a knob with the thumb and setting the frictional apparatus in motion, sparks pass between two points in the stem and ignite the gas. The inventor claims that the lighter is everlasting and will set fire to

THE "DYNAMO" GAS-LIGHTER.

nothing but gas, not even gunpowder or benzine, thus making it perfectly safe. The apparatus weighs only a few ounces and is neatly got up with brass or nickel-plated trimmings. The cut shows the application. Gas is turned on by means of the clutch at the top, and then the knob is pressed in order to generate the current for producing the spark.

Telephony in France and in England.

The Paris correspondent of the London *Times* contributed lately to that journal an interesting account of the progress of telephonic communication in the French capital. He says: "The working of the telephone in France, and especially in Paris, has been granted by a concession of the State to the Société Générale des Téléphones, and the extension of the term deserves notice now that social intercourse has been revolutionized by the use of this invention.

"It was generally thought that the Minister of Posts and Telegraphs would assume the working of it on the part of the State. Apprehensions on this score were entertained, and would certainly have arrested the diffusion of the telephone in France. There is in this country a latent dread of State inquisition, and everybody is persuaded that if the telephone were in the hands of the State verbal communications would cease to be a secret between the two speakers. No doubt this fear is groundless; but it is explained by the unceremoniousness with which the State takes cognizance of private telegrams; and foreign senders, especially from England, do not recollect that a non-ciphered telegram to any well-known personage is known to the government before it reaches its destination. It was therefore with some apprehension that the termination of the company's present term was awaited.

"As there is nothing harder to eradicate than prejudice, it is fortunate for the progress of the telephone and the satisfaction of the public that the concession of the Société Générale has been renewed for five years. Although, with his ordinary sagacity, M. Cochery has reserved the right of the State to take over the enterprise, the way in which the present company shall acquit itself of its duty will probably determine how long the public will enjoy immunity for its verbal communications from the ever-dreaded intervention of the official ear. No doubt so long as the Ministry of Posts and Telegraphs is confided to the scrupulous direction of M. Cochery no such apprehension need be entertained; but in a country of incessant changes, where a government inspiring confidence may be succeeded by one creating alarm, the public would not feel perfectly safe unless the often confidential and important dialogues passing through the telephone were safe from all official auditors.

"It is interesting from this standpoint to study the organization of the telephone service, which daily plays a more important part here, and the abolition of or interference with which would derange the habits of all Paris. The company possesses a central office, corresponding with twelve branches scattered over the city. With but few exceptions, the communication, which passes by the district office to the central, and thence to the person wanted, is obtained in from 30 to 40 seconds, and if this time be exceeded the delay is owing to the correspondent asked for not replying at once. The number of subscribers in Paris, according to the most recent statistics, is about 3,700, of whom 3,550 have communication and 150 are on the point of receiving it. The number of calls is on an average during the winter months 24,000 a day, and 1,000 a night, from 7 in the evening to 8 in the morning, which gives an average of seven calls a day per subscriber.

"As the subscription is 600 francs per annum, or two francs for each working day, a call costs on an average 28½ centimes. No telegram is so cheap or convenient as this, and the time taken for the delivery of a telegram averages an hour, whereas communication through the telephone is almost instantaneous. The rates, however, are considered high, and everybody expected a reduction in the new concession. This has not been made, the reason probably being that the Minister wished to avoid too keen a competition with the State telegraphs, and in view of the possibility of the State taking over the telephone, desired likewise to guard its liberty of action.

"As to the rates, the company's view is that the rent paid to the city for the use of the sewers and the 10 per cent. of the gross receipts paid to the State amount to about 25 per cent. of its earnings, while a marked reduction would bring such an influx of new subscribers that the lines could not for a long time be properly worked; besides which the telephone would be perverted into an amusement for idle people. The company now employs 200 persons, at salaries averaging 150 francs or 160 francs a month, lunch being provided for them.

"Fresh efforts have lately been made to accommodate the public without reducing the rates. Fifty telegraph offices will have telephone compartments, some of which are already fitted up; and for 50 centimes for five minutes a person may go and converse with a subscriber, or with anybody, at another office, with whom he has made an appointment. This system will steadily extend, and, although only begun three weeks ago, there has been an average of 60 communications a day. A person proposing to make a call will then, by going to the telegraph office, ascertain whether his friend is at home, and, if not, will save a useless drive.

"Another improvement suggested by M. Cochery, and agreed to by the company, is the establishment of a telephone station at the central telegraph office, so that for 50 francs a year, not including, of course, the charge for the telegram, a subscriber can telephone a message for transmission by telegraph. This not only saves trouble, but saves three-quarters of an hour for a telegram sent abroad and 25 minutes for one inside Paris. Another great step in advance, though not yet benefiting Paris, is the establishment, as mentioned last night, of telephonic communication between Rouen and Havre.

"I will conclude with a classification of some of the Paris company's subscribers possessing a certain interest, and which will suggest inferences to the reader: Bankers, 234 in 1884, and, owing to the closing of 14 unsuccessful banks, 222 in 1885; brokers, 102; newspapers, 71; printers, 65; cab proprietors, 60; booksellers, 56; engineers, 50; builders, 41; stockbrokers, 37; publicists, 30; clubs, 27; architects, 27; restaurants, 26; railway companies, 26; hatters, 22; insurance companies, 21; barristers and solicitors, 21; hotels, 21; cafés, 21; theatres, 15; dressmakers,

14; government offices, 9; physicians, 6; Chinese shops, 3; and embassies, 1, namely, that of Russia."

In its leading columns the *Times* referred to the communication given above, remarking that it "supplies materials for comparison with what has been effected in the same direction among ourselves. It appears from the account that the Parisians would have made little use of the telephone if it had remained in the hands of the government, so that communications might have been audible to official persons who were not intended to hear them, but that the grant of a renewed concession to the Société Générale is thought to have secured the privacy of messages, and that since this concession has been in force the instrument has come into far more general use in the French capital than in our own. The annual subscription in Paris amounts to 600 francs, or £24, against £20 in London; but the Paris subscribers are the more numerous. The total number is now 3,700, the last 150 being not yet supplied with instruments, so that only 3,550 are actually connected with the exchanges. In London, on Oct. 15, the total number of connected subscribers was 3,255, and the average monthly increase for the six preceding months had been 50, so that the total may by this time be 3,405. The average daily number of messages sent through each Paris instrument is seven, while the London Company state that only few instruments have a smaller daily average than five. When the enormously larger size and greater population of London are taken into account, it is manifest that the greater popularity of the telephone in the smaller city must be due, in some degree at least, to a more sagacious policy on the part of those by whom its distribution is controlled. One evidence of this is not far to seek. In London the use of the telephone is entirely restricted to annual subscribers, who have instruments fixed in their houses. The directors of the United Company divide mankind into two classes, subscribers and others—classes as distinct as Greeks and barbarians, as the chosen people and the Gentiles. The directors desire that the Jews should have no dealings with the Samaritans. They issue solemn warnings to their subscribers against the enormity of permitting any miserable non-subscriber to send a message over their lines. A man may be strictly upright and honorable in all his dealings, and the uneventful tenor of his life may be such that the post-office and the telegraph suffice for his customary requirements; but to the directors of the telephone company he is the merest outcast. If an urgent need for rapid verbal communication with some distant person should by any chance come upon him, it is held that he is rightly punished by being refused the means of gratifying his desire, and that he ought to feel a glow of satisfaction in the thought that he is made useful to his species as a warning and an example. The directors do not even extend a cordial welcome to proselytes, but endeavor to impress upon them that their adhesion should have been notified at an earlier period. After an annual subscription has been paid the hapless convert is compelled to wait some six weeks for his instrument, and he receives no privileges during his period of probation. The telephone companies have been plundered and bullied by the post-office, and the directors, like the footman in the 'School for Scandal,' revenge themselves upon any victim from among the public whom chance may throw in their way.

"They manage things better in France. Our correspondent tells us that in Paris fifty of the telegraph offices will have telephone compartments, some of which are already fitted up, and for 50 centimes for five minutes a person may go and converse with a subscriber, or with anybody, at another office, with whom he has made an appointment. In London, a subscribing tradesman can receive orders by telephone only from those persons who are themselves subscribers. In Paris he can receive orders from any resident in the city, and it would clearly be worth while for the London subscribers to put strong pressure upon the company for the sake of obtaining the facilities which are given in France. That it would be in the interest of the company to give them does not admit of doubt; and the warning against permitting non-subscribers to send an occasional message is a pitiable instance of the way in which short-sighted and grasping people may overreach themselves. To the vast majority of Londoners the telephone is only a name. They are theoretically well acquainted with its working, but they have no real practical knowledge of the convenience attending upon its use. The sooner they acquire this knowledge the sooner they will become subscribers. In some emergency a resident in one part of London wishes to communicate quickly with a resident in another part. He would first think of a telegram, but he remembers that his friend is on the telephone exchange. He might run to the nearest neighbor who was in the same position, and, but for the official prohibition, he might be allowed to pass a question and answer over his wire. The answer might need a word of explanation, and this also would pass. The experience thus gained would do more to produce a desire to have a telephone than any amount of reading or of theoretical information. It is unquestionable that, if the non-subscribing public had free access to telephones at the telegraph offices, no retail tradesman could afford to be without a fixed instrument at his place of business."

WESTERN NOTES.

THE ELECTRICAL WORLD BRANCH OFFICE,
CHICAGO, Feb. 12, 1885.

Mayor Harrison, of Chicago, undertook to talk with Mayor Grace, of New York, Thursday night, through Gillette's long-distance telephone, and was partially successful in doing so. The test was made over the compound wire of the Postal Company. This telephone has been described in THE ELECTRICAL WORLD. It is an aggregation of extremely sensitive diaphragms that will send pulsations by means of the sound of the voice over a good conductor, augmented by powerful batteries and an induction-killing device.

Chas. P. Willard & Co., 280 Michigan street, this city, are just commencing the manufacture in this country of the Davey safety engine, which seems to be adapted to the running of all dynamos. This engine is the invention of Mr. Henry Davey, a mechanical engineer of prominence in England, where he is known to the engineering world as the inventor of the differential pumping engine, now extensively used in the public water-works and mines of Great Britain, as well as to some extent in America. This engine possesses some novel features, and differs from an ordinary steam engine in that while a small quantity of steam is used, steam is not the motive power employed to do the work, and only as much is required as would be generated in an ordinary tea-kettle, and this at only atmospheric pressure; that is, at the same pressure at which it would flow from the spout of a tea-kettle, or escape from under the cover of a wash-boiler, or from under a pot-lid. The only function of the steam is to create, by condensation, a vacuum, which is the motive power. As there is no pressure in the generator, it is claimed there can be no danger from explosion under any circumstances. Only a few gallons of water per horse-power per day are required, and they can be returned and used over and over again. The cylinder, unlike that of other engines, does not require any oiling or lubrication, being made of bronze, with bronze piston-head and rod. In fact, it is intentionally constructed so that oil cannot be put into it. Unlike an ordinary boiler and engine, in which the water level in the boiler is a matter of vital importance, and any failure of the water supply fraught with more or less danger, the water level of the safety engine is constant and unvarying, and the quantity of water actually consumed so small as to remove all difficulty of keeping up a supply. Aside from the question of danger attending the use of the ordinary steam engine under careless management, there is probably no one thing which will commend this motor more strongly to the public than the fact that it requires no attention beyond simply lighting the fire, and giving the wheel two or three turns when ready to begin operations. There is no safety valve, no exhaust, no steam gauge, no gauge cocks, no boiler feed pump or injector, or any of these adjuncts of an ordinary steam engine. Anything that will go into the fire box may be used for fuel, and it is claimed that if coal or coke is used the cost of fuel will not exceed one cent per horse-power per hour. It is said to be three or four times as powerful as the hot-air engine, and that the cost of fuel is only one-fourth as great as for the gas engine. For the present the manufacture will be confined to engines under seven horse-power. Mr. Willard expects to turn the engine out in lots of one hundred at a time. It will be seen that some remarkable claims are made for this engine, and further developments in regard to it will be watched with interest. One of the engines driving a printing press can be seen at any time in Mr. Willard's shop.

Racine, Wis., thinks that she would prefer electricity to gas for street lighting, and the matter is being agitated.

The Elgin *Daily News* has a long interview with Mr. Stiles, general manager of the Van Depoele Electric Manufacturing Company, about electric lighting matters in general. If Mr. Stiles is correctly reported, he believes that the days of high prices for electric light apparatus are past, and that hereafter dynamos and lamps will be manufactured and sold at a comparatively small profit.

In THE ELECTRICAL WORLD of Jan. 31 mention was made in these columns of the fact that a Chicago bucket shop had gone into court for the purpose of having the officers of the Baltimore & Ohio Telegraph Company and of the Board of Trade attached for contempt. As the decision in this case will probably settle the question in Chicago as to whether the bucket shops are hereafter to have quotations or not, the outcome of this suit has been looked forward to with a good deal of interest. The matter was virtually disposed of in Judge Moran's court on Friday, the 6th, although formally the judge took it under advisement, and in all probability the bucket shop will lose the case. It will be remembered that the alleged contempt was for violating an injunction restraining the Baltimore & Ohio Telegraph Company and the Board of Trade from cutting the wires or removing the tickers over which the market quotations were sent from the board to the rooms of the Public Grain and Stock Exchange, at No. 131 La Salle street. It also enjoined them from withholding the market quotations from the exchange. The injunction, as far as the Board of Trade was concerned, was dissolved some time ago, and it was only claimed that the telegraph company had violated the latter part of the injunction by withholding the quotations. It had not cut the wires, but sent nothing over them. It did, however, send the quotations by other wires to twenty-two customers in other parts of the country. The telegraph company claimed that its agents had been denied access to the floor of the board, and it was a physical impossibility for it to send the quotations to the Grain and Stock Exchange, as it did not have them. The quotations which it sent to the other customers were in the form of private dispatches, which the company had no right to disclose to others than the persons to whom they were sent. This the attorneys for the exchange claimed was simply an evasion of the letter of the injunction, and the worst possible form of violation of its spirit. The attorneys engaged upon the case were Mr. Goudy and Mr. Jenks for the Grain and Stock Exchange, Mr. C. C. Clarke for the telegraph company, and Judge Beckwith for the Board of Trade. Judge Beckwith and Mr. Clarke had previously mage arguments upon the motion, and the arguments of Mr. Goudy and Mr. Clarke took up the entire day. At their close Judge Moran suggested that it would be better for the complainants to file a supplemental bill, reciting the manner in which the injunction had been made valueless by the action of the Board of Trade, and asking that the action against the board be revived or a new one granted. He thought there was no desire to avenge anything, but simply to settle the question whether the board did actually have such an ownership of the market quotations that it could control them and give them out or withhold them as it pleased. To fine the telegraph company now would not settle that question. The judge intimated, also, that if it was a physical impossibility for the telegraph company to obey the mandatory injunction it ought not to be fined for not obeying. It had been said by the attorneys of the telegraph company that they understood the court to hold, when the injunction against the Board of Trade was dissolved, that the board had the right to admit on its floor or bar out any one it pleased. On this point, Judge Moran said that if he did so state it was unintentional, as he did not think that such a thing was in his mind when he dissolved the injunction. The judge took the motion under advisement, and the attorneys are to consult as to whether they will file the supplemental bill. From Judge Moran's remarks, it is not likely that he will grant their motion to punish the telegraph company for contempt.

The Electrical Supply Company are receiving goods daily now at their new place, 175-177 Lake street, Chicago, and the stock is pretty nearly complete. The business here is under the charge of Messrs Reed and Terry, who will be glad to see their friends and the friends of the company at the new office. It is becoming more and more apparent that it is useless for Eastern houses to attempt to do business in the West without an office in Chicago.

The Sperry Electric Light Company held their annual meeting Feb. 2 and 3. The officers for next year are: Dr. Galusha Anderson, President; C. B. Nelson, Vice-President; E. B. Palmer, Secretary and Treasurer; Elmer A. Sperry, Electrician; C. M. Greene, General Manager; Board of Directors, Galusha Anderson, C. B. Nelson, E. B. Palmer, E. A. Sperry, W. T. Tisdale, F. H. Ludington, Jesse Vandenburgh.

The town of Newton, Iowa, is well pleased with its recently installed electric light plant. Over twenty lamps are in use by various houses, and the public square is lighted by six lights on a 75-foot mast.

The Proposed Electric Light Convention.

There has been some agitation in Chicago looking to a National Electric Light Convention. Mr. Geo. A. Bowen, so long connected with the Elgin Electric Light Company, has been mainly instrumental in putting this matter under way, and he seems to have succeeded in getting pretty nearly all the companies interested in such a convention. There has been a call issued for a convention to meet Feb. 25, and a preliminary meeting was held at the Grand Pacific Hotel, on Tuesday evening, at which all the companies excepting the Brush and Edison were represented.

Mr. C. A. Brown, of the Western Electric Company, was elected Chairman, with J. H. Reid, of the Electrical Supply Company, as Secretary. The report of the secretary is given below:

At a meeting of electric light representatives held at the Grand Pacific Hotel, Chicago, on the evening of Feb. 3, presided over by C. A. Brown, of Western Electric Company, resolutions were passed that the chairman appoint the following committees:

Committee of Arrangements—Geo. S. Bowen, Van Depoele Electric Manufacturing Company; C. C. Warren, United States Company; E. B. Palmer, Sperry Electric Light Company; Geo. L. Crossman, Thomson-Houston Company; C. A. Brown, Western Electric Company; Wm. A. Hammett, the New York Safety Steam Power Company.

Committee of Invitation—E. A. Sperry, Sperry Electric Light Company; F. S. Terry, the Electrical Supply Company; Geo. S. Bowen, the Van Depoele Electric Manufacturing Company.

Finance Committee—M. A. Knapp, Railway Telegraph Supply Company; S. S. Badger, Badger Electric Company; M. A. Buckley, Excelsior Electric Light Company.

Treasurer—W. A. Kreidler, Western Agent of THE ELECTRICAL WORLD.

The Committee of Arrangements are preparing a circular to be sent to the different companies.

THE TELEGRAPH.

Favoring a Postal Telegraph.—A joint resolution introduced in the Ohio Legislature by Mr. Roche instructing the Ohio delegates in Congress to favor by all means the Sumner postal telegraph bill has been adopted.

The B. & O. Telegraph System.—The directors of the Baltimore & Ohio R. R. have adopted a resolution ratifying and confirming all previous action of the executive officers in regard to the expenditures required for the extension of its telegraph system.

Police Telegraph at Lowell, Mass.—An Aldermanic investigation is being conducted at Lowell, Mass., with regard to the manner in which police telegraphs were introduced there. It is claimed that there was jobbery, as the contract runs for several years giving a rental from the city of $2,220 per annum, while the cost of plant is figured at only $2,300 or $2,400.

An Important Missing Link.—In the U. S. Senate, on the 7th inst., Senator Morgan reported favorably from the Committee on Foreign Relations the bill introduced by him a few days before to construct and maintain a telegraph and cable line between the Pacific Coast of the United States and the Asiatic Coast, with an amendment providing that the line must be completed within ten years.

Underground Fire-Alarm Wires.—The Washington *Critic* says the recent fire in the office of the *Star* of that city shows the importance and superiority of good underground cables. The cable laid by the underground cable company here more than a year ago has been used on one of the Fire Department circuits, and proved to be better than the overhead wires, and they have not failed in one instance to work promptly.

Chicago Wires.—Rapid progress is being made in Chicago in getting rid of aerial telegraph and telephone wires. The work of placing the wires under the ground is going forward without attracting attention or disturbing business. There are now 718 miles of underground wires in the city, and the *Inter-Ocean* predicts that in a year or two aerial wires in Chicago will be as much a thing of the past as the erection of frame buildings within the city limits.

B. & M. Troubles.—The Bankers & Merchants' Telegraph Company is again in trouble with its operators. The latter a few days ago received 12½ per cent. of their January wages; yesterday 37½ per cent. more was paid them; 50 per cent. is still due. The operators are restive and continually threaten to strike but the company quiets them by a partial payment of their wages. The company is in a receiver's hands and has difficulty in meeting its current expenses, and it was said that the Baltimore & Ohio and Postal companies demand that it make daily settlements with them of all reciprocal business.

Mexican Telegraph Company.—At a meeting of the Board of Directors of the Mexican Telegraph Company on Feb. 3, a semi-annual dividend of 4 per cent. was declared, payable Feb. 11. The net profit for the year ended Dec. 31 was over 10½ per cent. The company is without any bonded or other indebtedness, and has an available surplus amounting to $211,337. Notwithstanding the depression in business the traffic for 1884 shows a satisfactory increase over that of 1883. The present traffic of the Central & South American Telegraph Company shows an increase of 35 per cent. over the corresponding period last year.

"Uncle Cyrus" Triumphant.—A cable dispatch of Feb. 7 from London says: The contest over the re-election of Mr. Cyrus W. Field and Sir Bache Cunard as directors of the Anglo-American Telegraph Company went to a poll to-day. At the meeting yesterday Sir Bache Cunard was rejected by a vote of 48 against 23, and Mr. Field by a vote of 39 against 33. The directors held hosts of proxies, beside which a number of personal votes were recorded. The result of the vote to-day was as follows: In favor of Messrs. Cunard and Field, 34,877 shares, representing 1,068 voters, holding £2,566,039 of stock; against Messrs. Cunard and Field, 165 shares, recorded by only three voters, holding £34,612 of stock.

Beating the English War Office.—A cable dispatch of Feb. 7 from London says: The government officials are taking extraordinary precautions to prevent the publication of damaging news from the Soudan. At an early hour yesterday morning the Central News received from a wounded correspondent at Korti the text of a dispatch of Gen. Wolseley, which threw upon the war office the onus of blame for the recent disasters. The same agency had dispatches announcing the fall of Khartoum five hours before the Pall Mall magnates allowed the information to be officially circulated. The officials were both disgusted and alarmed at the strokes of enterprise, and they invented a theory that messengers coming from the cable office to Pall Mall were bribed by the Central News to allow their messages to be taken from the envelopes and copied. In order to circumvent this imaginary fraud, the government has ordered wires to be laid from each of the cable offices to the war office. The Central News has returned the compliment by furnishing the war office with duplicates of dispatches as fast as received, and the war office is now well posted.

Telegraphers Reorganizing.—A dispatch of Feb. 4 from Pittsburgh says: The Telegraphers' Protective Union has been reorganized on a larger and more comprehensive scale than it had achieved prior to the great strike. Plans have been perfected and a substantial union formed by means of which telegraphers claim that they expect to be able to maintain what they consider equitable relations between the telegraph corporations and their employés. It is claimed by those in position to know that the experiences of the last strike have been most valuable to the fraternity. They have found out their weak spots, and have taken, they say, judicious and effectual means to strengthen them, and that when the time comes for the presentation of another "bill of grievance" to the company that the same will be given a careful and reasonable consideration by the executive officers of the Western Union Telegraph Company. As yet the union men have not decided when they will make a statement to the company. A high authority among the telegraphers stated that the company wanted to get the salaries for first-class men, now ranging from $80 to $90 per month, down to $50 per month, but he maintained that the company would never be able to do so. "We will pursue," he said, "either of two courses of action—first, we will make an appeal to the higher officers of the company to listen to our grievances, and, if we do not get a just redress, join in an open revolt; secondly, we will make an appeal in behalf of the thousands of telegraph operators of the country to Congress and ask that the government take hold of the telegraph lines." The new union will not only embrace the telegraph operators, but officials and clerical employés whose employment is such that it requires considerable experience.

THE TELEPHONE.

Around Montreal.—Mr. Johnston, president of the Dominion Telephone Company, says that arrangements are being made to establish an exchange in Montreal, and to connect it with the eastern townships and with Ottawa.

Changes of Personnel.—Mr. William A. Ingham has resigned as president of the Union Telegraph and Telephone Company, and E. H. Peters, of Saratoga, N. Y., has been elected to fill the vacancy. The Union Company covers the territory of Washington, Warren and Saratoga counties in New York.

Telephone Right of Way in Germany.—It is reported that the local authorities of Neu-Isenberg, Spendlingen, and Langen oppose the passage over their territory of the telephone wires for connecting Frankfort and Mannheim, and that the whole question as to this "right of way" is now before the German law courts.

"What Number?"—A tradesman who is doing business in a neighboring village was told that hereafter when he desired to talk by telephone with business men here he would have to call them by their numbers. He took the street numbers of several business houses on Saturday, going considerably out of his way to secure them.—*Dayton (Ohio) Democrat.*

About a Parrot.—A lady, recently visiting on State street, brought a parrot with her, which, beside wonderful proficiency in the profane art, seemed to understand the *modus operandi* of the telephone. A young man on the same circuit assures the *Journal* that, a few days ago, he heard the feathered linguist tell the operator in the central office to connect him "with the store," accompanied by certain ejaculations more irritating than polite. Whereupon a sweet young voice came over the wire: "If you don't stop that kind of talk, young man, I'll have that telephone taken out. You'll see if I don't."—*Albany State Journal.*

In the Dominion.—A Canadian correspondent says: "The Black & Roxburgh telephone system has now been in successful operation on the G. N. W. T. Company's lines for about three weeks. It is under the management of Mr. B. B. Toye, and he and the general manager, Mr. H. P. Dwight, appear to be surprised and gratified at the working of the invention. The Bell Telephone Company are also becoming interested, and a very satisfactory test was had lately on their wires between Toronto and Hamilton, a distance of 40 miles. Mr. C. F. Sise, general manager; Mr. H. C. Baker, manager for Ontario, and Mr. H. Neilson, the Toronto agent, were present and pronounced the test thoroughly successful.

Fire.—On the 1st inst., the $65,000 residence of Mr. Shaver, president of the Consolidated Telephone Company, situated at Edgewater, Staten Island, was burned down. After the fire was discovered the people there found that the telephone wire had been cut, and that the firemen could not be summoned over the line. When the firemen finally arrived only a tall chimney and a pile of ashes remained. Among other things burned was a marble table once owned by George Washington. It was also found that telephone wires had been cut all over the island, the cutting being attributed to animosity caused by a reduction in the wages of employés of the telephone company. Some fifteen years ago, Mr. Shaver was an operator in the Western Union service.

Intercontinental.—An analysis of the accounts of the Intercontinental Telephone Company, doing business in Caracas, La Guayra and Valencia, shows that for the five months from July 1 to Dec. 1 the company earned gross $13,097.48, an average of $2,619.50 per month. The expenses were $5,926.04, an average of $1,059.21 per month, and the average net earnings $1,518.69 per month. This would be at the rate of, say $18,000 per year from the 340 subscribers which the company then had. But the number of subscribers increased to 446 in December, with a prospect of reaching 500 early in January. The added 160 at $5 each per month would increase the gross earnings by $800, with a nominal increase in expense. On this basis the management hopes to show net earnings of $25,000 for 1885.

River Plate Telephone Company.—The shareholders of the River Plate Telephone Company and the Consolidated Telephone Company will doubtless be glad to hear that the manager of the former company, while on a short visit to England on business matters, reports that it is doing very well indeed, that all the leading people of Buenos Ayres are on the exchange, and that the government uses the Gower-Bell instrument in preference to the Bell and Blake. The latest returns show 1,300 paying subscribers in Buenos Ayres, and a large increase in Montevideo since the company reduced its rates for subscribers to meet the opposition tactics; and no doubt this increase will be maintained, as the Gower-Bell instrument is fully appreciated in the Argentine Republic, and it was solely the higher rates which drove the subscribers away.—*London Electrician.*

THE ELECTRIC LIGHT.

Ithaca, N. Y.—A company has been organized at Ithaca, N. Y., for electric lighting. The Brush system will be used, and the prime power will be furnished by two Ball engines of 60 horse-power each, and two steel boilers.

The Largest in England.—It is stated that the administration of the Alexandra Palace, in the north of London, have closed an agreement with the Gülcher Electric Light Company for the largest plant in England. The lights will be distributed all over the palace and grounds.

Binghamton, N. Y.—Last December the People's Electric Light Company of Binghamton obtained an order from the court making its corporate name "The Brush-Swan Electric Light and Power Company of Binghamton, N. Y." On Feb. 9, after conforming to all preliminary legal requirements, the stockholders voted to increase the capital stock from $50,000 to $100,000. The officers are: President, H. G. Jackson; Secretary, Fred. Bennett; Treasurer, F. G. Ross; General Manager, John Anderson.

Pittsburgh, Pa.—The Allegheny County Light Co., of Pittsburgh, Pa., declared a dividend of 3½ per cent. out of the earnings for six months ending January 1st, 1885. Mr. H. H. Westinghouse has resigned the presidency of the company, and has removed to New York City to represent the Westinghouse Machine Co., of Pittsburgh. The annual meeting of the stockholders will be held on February 10th, 1885. The company is running 300 arc lamps (Brush system) in the cities of Pittsburgh and Allegheny, and is in a very prosperous condition.

A Good Example for Gentiles.—The Salt Lake Power, Light and Heating Company held a meeting on Jan. 22. The affairs of the company are in a very satisfactory condition, Major G. S. Erb, president and manager, resigned his position, and Thomas Marshall was elected to fill the vacancy. The other officers of the company remain the same. A quarterly dividend of seventy-five cents per share was declared and made payable Feb. 10. This is dividend No. 10. The corporation has a capital of $50,000, divided into shares of $25 each, so that the dividends amount to one per cent. per month on the capital stock, and there remains a reserve fund besides, making a very satisfactory investment to the men who put their capital into the enterprise.

Startling the Natives.—A correspondent who was at the annexation proceedings in New Guinea, writing to the *Register*, says: "The 'Nelson' was lying at anchor some miles from the village; but, by the aid of her electric light, the huts on shore could be plainly distinguished. Then for the amusement of the natives the siren or fog-horn of the 'Nelson' was sounded. The effect was ludicrous in the extreme, the instrument alternately groaning and barking and making the most extraordinary noises. In some instances I was informed the natives thought the two electric lights to be the eyes of some great monster; and, when they heard the sounds of the siren, they immediately concluded that it was the voice of the monster, and numbers of them ran away and hid in the bush in terror. While the illumination was proceeding, the moon rose through a light bank of clouds over the hills, and the electric light and firing off of rockets was one of the prettiest sights that anybody could wish to see."

In an English Theatre.—The electric light is to the front in the "Forty Thieves" pantomime this year at Nottingham. Each of the forty carries in his armor small incandescent lamps, one on the spear, one in the helmet and one in the shield, the result being an electric fairy ballet of (with captain and officers) 129 fairy lamps. For this scene alone 376 elements are used, and require five gallons of solution to charge them. Each of the "Forty Thieves" carries a 9-cell bichromate battery, three cells being used for each of the three lamps; the wires are mostly inside the dresses, and the connections (486 in number) with the dresses, armor and batteries require to be made quickly and securely, as the changes from one scene to another are very rapid. There are 376 zinc and 752 carbon elements, the carbons being double in each cell. The whole battery of nine cells measures 8 inches by 2½ inches by 4 inches. Some idea of the magnitude of the undertaking may be gathered from the fact that 1,640 electric contacts must be perfect before the whole of the lamps can be lighted. The scene is a most charming one. The firm of Oppermann Brothers, London and Chicago, has made the special lamps.

MISCELLANEOUS NOTES.

Electrical Exhibition.—The Electrical Exhibition, organized by the Société Internationale des Electriciens, will be opened at the Paris Observatory on March 15.

How to Minimize Storms.—According to a French scientist the force of storms can be lessened by placing a large number of lightning rods on the telegraph poles along railway lines.

A New Current Meter.—The Gerboz measurer of electric current depends for its action on the gauging of a quantity of water, which only flows while the current is passing. The latter actuates a number of valves by means of an electro-magnet.

Beaten Aluminium Leaf may now be obtained in books like silver leaf, and is largely used instead of silver for decorative purposes. Mr. Levison suggests heavy aluminium leaf as a substitute for tin foil for coating Leyden jars and similar electrical apparatus. Area for area, it does not cost much more, is much lighter, and permanently retains its polish. A book of fifty leaves of aluminium, of the ordinary thickness, costs twenty-five cents, of a thickness suitable for Leyden jars, fifty leaves, about four inches square, costs $1.00.

A Pretty Phenomenon.—At the rope-walk in the navy yard at Charlestown, Mass., there is a very large belt, and in one place, where it passes through a dark room, one who holds his hand over it, with the fingers pointing downward, will often see a beautiful violet-colored fan of flame spreading from his fingers to the belt. A large glass disc used to be kept there, and, if one stood on it and held his fingers over the belt, he would soon become highly charged with electricity, and could give a smart shock to any one standing near by bringing the finger of the other hand close to him.

Electro Cylinder Mills.—Dr. J. H. Rae left Boston about Feb. 3, for California, under contract to erect two electro cylinder mills, one of 15 tons at Santa Cruz, one of 30 tons capacity at Humboldt Bay; these mills are for working the beach sands, Dr. Rae guaranteeing to recover 80 per cent. of the "*free gold*" contained in the sands, expense of working the sands not to exceed $2 per ton. Dr. Rae had issued to him the first electro metallurgic patent ever issued in any country, and has been studiously at work experimenting ever since, now some twenty years. He has a large and important field. There is no doubt of success, even up to 95 per cent.—*Mining Review.*

Obituary—James Hopson Banker.—This gentleman, for many years vice-president of the Bank of New York and identified with many financial affairs of magnitude, died at his residence in Irvington-on-the-Hudson on the 10th inst., at the age of 58 years. Mr. Banker was born in this city. He was a son of Edward Banker, of the old firm of Banker, Schermerhorn & Co., ship chandlers. He grew up in that business, and carried it on so suc-

cessfully that he made a liberal fortune. Subsequently he became connected with the Bank of New York as its vice-president, a position he held some years. Mr. Banker was a long-time friend of Commodore Vanderbilt, and was closely associated with him in developing the New York Central, Harlem, and Lake Shore railroads. In all of the corporations he was a director and an acting member of the managing executive committees. He was also a director in other large corporations. When President William Orton, to strengthen the Western Union against the attacks of Jay Gould, induced Mr. Vanderbilt to buy largely of the stock of that company, Mr. Banker, with Horace F. Clark and Augustus Schell, entered the Executive Committee of the company. He remained an active and useful member of the committee until failing health forced him to retire from the cares of business. During the later years Mr. Banker took a deep interest in Thomas A. Edison's system of electric lighting, and was a member of the boards of the Edison Electric Light Company and of the Edison Illuminating Company of New York.

APPLICATIONS OF POWER.

The American Electric Railway Company.—A number of electricians and capitalists met in the office of Cyrus W. Field last week, and completed the subscription to the stock of the new American Electric Railway Company. A sufficient amount of money has been raised to lay extra rails on the Second avenue elevated railroad structure and to make a thorough test of the electric motor. The certificate of incorporation of the company has been filed in the county clerk's office. The corporators and trustees for the current year are Cyrus W. Field, Edward H. Johnson, Frederick F. Thompson, Stephen D. Field, Robert E. Deyo, Edward N. Dickerson, Jr., Charles Batchelor, Francis R. Upton, and Daniel A. Lindley. The capital stock is $1,000,000, divided into shares of $100, and the company's purpose is stated to be to build, own, sell, or let locomotive engines, cars, rolling stock generally, and railway machinery.

Baltimore Tram Cars to be Run by Electricity.—Preparations are now being made to run the Hampden street cars from the Union car stables, on Huntingdon avenue, to Hampden, Baltimore County, by electricity. The electric system to be used is the "Daft system." A 75 horse-power engine to drive a 50 horse-power electric dynamo will be located at the Huntingdon avenue stables. The third rail, extending from Huntingdon avenue stables to the terminus, at Leef's drug store, Hampden, will be charged with electricity. A trial of the apparatus will be made with two electric motors of 10 horse-power each. These motors will be double-enders, that is, will be finished alike at both ends, and will run in either direction, with power enough to haul from one to three loaded cars at the rate of 12 or 15 miles an hour if desired. The rails for the third track have already been distributed along the line. Work on the foundation of the machinery for generating the electricity was begun on the 9th inst., and the whole thing, it is proposed, will be in practical working order by the middle of March.

STOCK QUOTATIONS.

Telegraph, telephone and electric light quotations on the New York Stock Exchange, Boston Exchange and elsewhere are as follows:

Telegraph.—Am. Cable, b 54, a 55; B. & M., b 3, a 7; Mutual Union, b 12½, a 14½; Postal stock, b 1, a 2¾; Postal sixes, a 24; Western Union, b 62¾, a 62⅞.

The way Western Union is handled by the bull clique is the subject of comment by the street, and is considered marvelous. On Tuesday morning the stock lent at 1-128@1-64 per cent. per diem, with W. E. Connor & Co. as the only large lenders. When it is considered that there is $80,000,000 of the stock, the fact that the shares lend at premium is remarkable. The bulls on the stock are naturally jubilant, and claim that there will be only two telegraph companies in existence by to-day—the Baltimore & Ohio and the Western Union. They say that operators of the Bankers & Merchants' and Postal Telegraph Companies will strike for salary long overdue. The Postal Telegraph people, however, emphatically deny this, and so do the company's employés. At the Bankers & Merchants' offices nothing can be learned in reference to the statements made above.

Telephone.—Am. Bell, b 216, a 217; Erie, b 20½; Mexican, b 1½; New England, b 29¾, a 30; Tropical, b 1¼.

Electric Light.—Am. Elec. com., b 2½; Am. Elec. pref., a 8½; Edison, b 60, a 90.

BUSINESS NOTICE.

The Bogart Consent Decrees Again!—As to the "invalidation and exposure" paper of Mr. A. L. Bogart, in the last ELECTRICAL WORLD, there is little required after our previous statement, and that little is a simple conviction of Mr. Bogart's mis-statements, express and implied.

1. We did *not* have permission or the power to defend the "consent decree" suits through our counsel.
2. The attorneys for the former agent, the defendant, were *not* at the time of the "consent" our attorneys; nor had they any right to "consent" for us; nor were we represented.
3. If any "deliberate advisement" were had, it was *not* with a view to *our* rights, or with us or with our counsel.
4. Our counsel was *refused* admission to the suits.

Therefore, "intelligent people" will *not* see how these decrees affect, at all, our pending suits against Mr. A. L. Bogart, for the speedy prosecution of which he need have no fears.

We do not wish to prejudice the Trade against Mr. A. L. Bogart; but we *do* wish him and the Trade to distinctly understand that no "consent decrees" mentioned by him will affect the suits upon our patents against him; nor will such "consent decrees" constitute a defense to any person or persons appropriating our inventions.

We never yet entered a "category," and so fail to appreciate the horrors thereof. So far as they consist in penalties arising from "Bogart Patents," it does not strike us as exactly a "chamber of horrors!" Very respectfully,

THE ELECTRIC GAS-LIGHTING COMPANY
(By LOUIS W. BURNHAM, President).

BOSTON, Feb. 11, 1885.

OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

PATENTS DATED JAN. 27, 1885.

Electric Light Tower; John S. Adams, Elgin, Ill., Assignor to the Detroit Iron Tower Company, Detroit, Mich..... 311,166

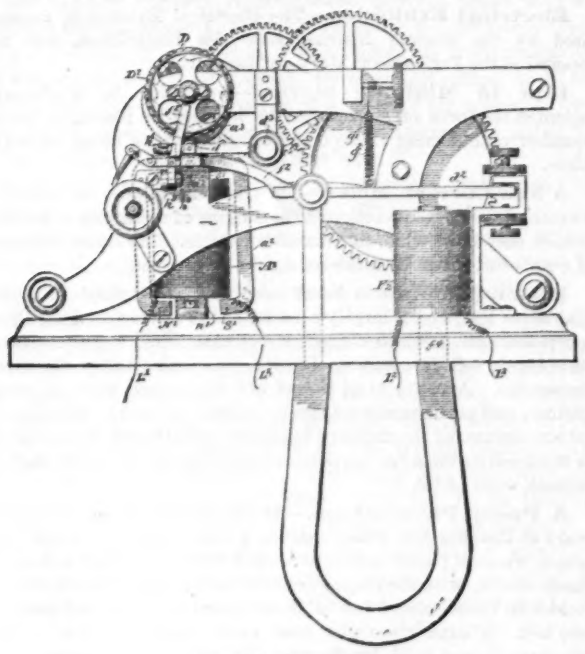
Consists in a trussed skeleton tower of prismatic form, or of uniform horizontal dimensions at all points of its height. The mode of supporting the trussed skeleton tower when located at a street corner, or at a point where it is desirable to avoid obstruction to passage, constitutes the second novel feature of the invention, and consists in sustaining the tower in a raised position by means of a central post, which, in a street, will ordinarily rise from the corner of the walk. The tower will in this case be supported laterally by guys extending to the ground or to neighboring buildings.

Electric Cable; Henry A. Clark, Boston, Mass..... 311,174

It is composed of a central electric wire or wires surrounded by a series or layer of electric conducting wires, one or more of which are bare and the rest insulated, which are covered with an electric conducting material and an outside protecting covering.

Printing Telegraph; John E. Wright, New York, N. Y., and J. Holmes Longstreet, Hoboken, N. J..... 311,218

The invention relates to the class of printing telegraphs, in which



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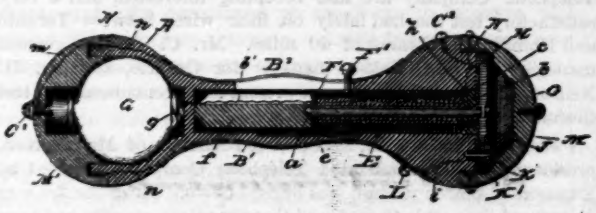
the step-by-step movement is given through the instrumentality of an escapement actuated by an independent electro-magnet, while the impressions are taken from the type-wheels through the agency of electro-magnets included in an independent main line. A' is an electro-magnet included in a main line L', and vitalized by means of alternating electric impulses. Applied to this electro-magnet is an armature a', consisting of a permanent magnet bent into such form that its respective poles N' and S' will extend into proximity to a widened pole n' of the electro-magnet A'. The permanent magnet is pivoted at the neutral point to the remaining pole s' of the electro-magnet A'. There exists between the pole n' and the pole N' a repulsion, and between the poles n' and S' an attraction. The type-wheel D is provided with two beveled faces D' and D^2, which are respectively designed to carry letters and figures. Impressions are taken from these two type-wheel faces by means of a platen d, which may be actuated by means of either of two armatures d' or d^2, which are respectively applied to two electro-magnets F' and F^2.

Electric Clock; Augustus S. Crane, Newark, N. J... 311,234

An armature is alternately attracted by a magnet and pulled away by a spring. To the armature is connected ratchet gearing for converting the reciprocating motions into a rotary motion, which serves automatically to break and connect the current at the right intervals.

Method of Preparing the Elements of Storage Batteries; A. K. Eaton, Brooklyn, N. Y..... 311,236

The process of producing a mixture of sponge lead and peroxide of lead useful in the manufacture of storage batteries consists in treating red lead with acetic acid, and of then treating the resulting product with zinc. The action of the zinc upon the ace-



PATENT NO. 311,381.

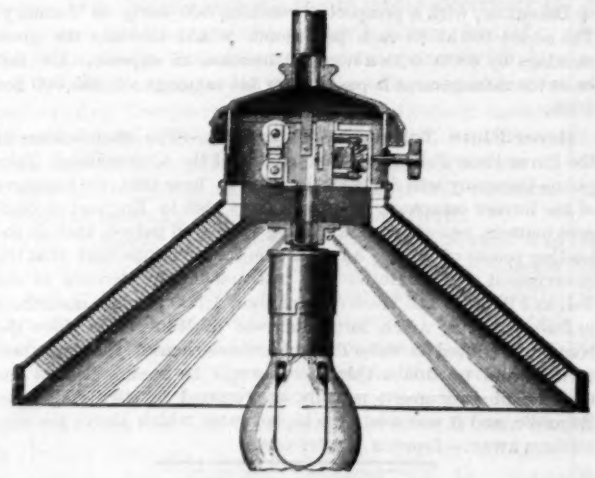
tate of lead precipitates spongy lead, which, as it is formed, mixes with the peroxide of lead.

Indicator for Base-ball or Cricket Fields; William Williams, Huntingdon, Pa..... 311,278

This invention relates to indicators for base-ball or cricket fields, or that class of devices which are used to signal the umpire when the runner steps on the bases; and it has for its object to provide an automatically operating attachment for the bases, said attachment connecting with an electric bell, so that when the runner steps on or passes over the base the bell will sound, so as to prevent all disputes.

Telegraph Repeater; Joseph Kölzer, Duisburg, Prussia, Germany..... 311,330

This invention relates to a telegraphic apparatus whereby messages can be transmitted from a remote station in the main line to a remote station in the branch line, from a remote station in the branch line to a remote station in the main line, and also for sending messages from a station on a branch line to a home or receiv-



PATENT NO. 311,398.

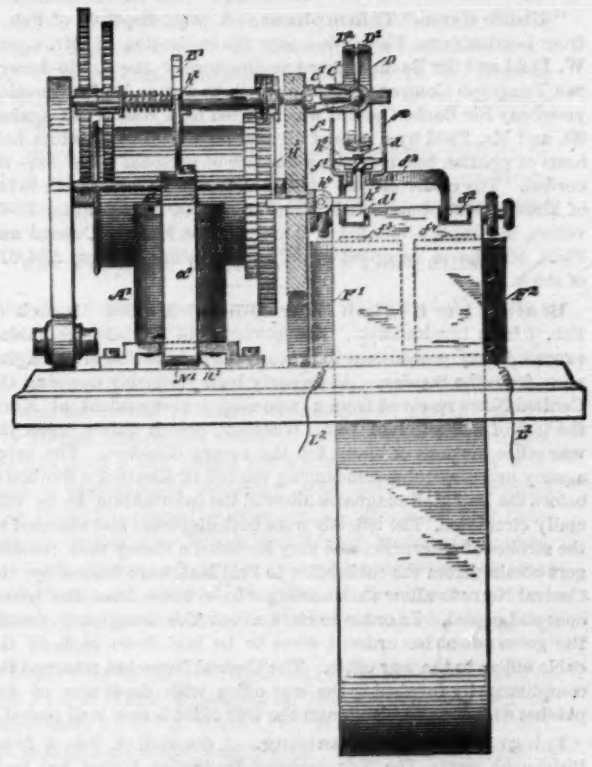
ing station that has been disconnected from the main line or electrical circuit. The invention consists in a polarized electro-magnet, whose armature lever is provided with an adjustable tongue or extension, and an arrangement of circuit-closing or finger keys, commutators, registers, and main-line and branch-line electrical circuits, whereby messages can be transmitted in the manner above briefly indicated.

Electrical Exercising Apparatus; James H. Shaw, New York, N. Y..... 311,381

Consists in the combination, with the rheophore dumb-bell containing the battery and inductorium of the apparatus, and provided with suitable manual contact-plates, of an electrode dumb-bell also provided with manual contact-plates, and a conducting wire adapted to connect the two and close an electrical circuit through the same to include the body of the person holding the two dumb-bells. Within a central longitudinal cylindrical chamber formed in the dumb-bell A' is fitted an induction-coil E, constructed, in the customary manner, of a primary coil of insulated wire b, wound about a central core and overlapped by an outer secondary coil of finer insulated wire c. An insulating coating or envelope is laid upon the outer coil, and upon this is fitted a cylindrical metallic case or damper F, of about the same length as the coil, and which is adapted to be slid off and on the same within the cylindrical chamber by means of a pin or button F^v, projecting from the slide outward through an extended slot in the casing, its too free movement being prevented by a lateral spring e, interposed between it and the inner side of the containing-chamber.

Electric Lamp Fixtures; Edward Weston, Newark, N. J..... 311,398

In other applications filed by him he has shown and described a system of electric lighting which may be thus briefly described: In cross or multiple circuits between two main conductors a given number of incandescent lamps are arranged in series. With each lamp is associated a manual switch and an automatic switch, for convenience designated a "cut-out," which is brought into operation when the lamp is extinguished, either by the destruction of the carbon or by a movement of the manual switch. The operation of the cut-out brings in a shunt-circuit around the lamp, including



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a resistance equal to that of the lamp. To adapt the system to practical use and to facilitate the renewal of lamps without disturbing or altering the other parts, he provides fixtures or casings, to be permanently secured in any desired position, and in them he arranges the devices named, adjusted and connected up ready for operation, and he provides means by which the lamps may be secured to or removed from the same. In the space between the two sheets C D, he places the coils of an ordinary resistance, and in order to bring as great a length of wire into as small a space as possible, and at the same time obtain a proper ventilation of the coils, he winds the wire spirally on narrow wooden strips a a.

Secondary Battery or Electric Accumulator; S. Philippart Fils, Paris, France, Assignor to the Electrical Power Storage Co. (Limited), London, Eng. (Patented also in France, Belgium, Germany, Great Britain, Italy, Spain and Austria-Hungary) ... 311,445

Consists in making the electrodes or elements of the couples in the form of cups or vases with solid sides and bottoms, so that they may serve to hold the exciting liquid, and in nesting together or assembling a series of such cups or vases—one inside the other—so that they constitute a series of cells equal to the number of such cups or vases less one.